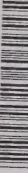


Electronic Services - Los Angeles



M12364X

General Electric Company
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Salt Lake City, Utah 84104
(801) 973-2253



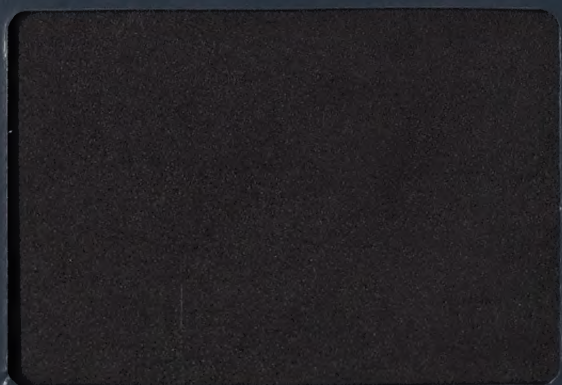
Instruction Manual

Model

1952 B

Universal
Counter-Timer

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Instruction Manual

GENERAL ELECTRIC
INSTRUMENTATION & COMMUNICATION
1200 KONA DRIVE
COMPTON, CA 90220
(213) 642-5317

Model

1952 B

**Universal
Counter-Timer**

LIMITED WARRANTY

The JOHN FLUKE MFG. CO., INC., warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of one year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries (rechargeable type batteries are warranted for 90 days), or any product or parts which have been subject to misuse, neglect, accident or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within one year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within one year of the original purchase, said repairs or replacement will be made without charge. If the fault has been caused by misuse, neglect, accident or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

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2. On receipt of the shipping instructions, forward the instrument, transportation prepaid. Repairs will be made at the Service Facility and the instrument returned, transportation prepaid.

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CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The John Fluke Mfg. Co., Inc. will be happy to answer all application or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. Box 43210, MOUNTLAKE TERRACE, WASHINGTON 98043, Atten: Sales Dept. For European Customers: FLUKE (Nederland) B.V., Zevenheuvelenweg 53, Tilburg, The Netherlands.

* For European customers, Air Freight prepaid.

John Fluke Mfg. Co., Inc. • P.O. Box 43210 • Mountlake Terrace, Washington 98043

Change/Errata Information

Issue No: 4 6/79

This change/errata contains information necessary to ensure the accuracy of the following manual. Enter the corrections in the manual if either one of the following conditions exist:

1. The instrument's pcb revision letter is equal to or higher than that which is indicated at the beginning of the change.
2. No revision letter is indicated at the beginning of the change/errata.

MANUAL

Title: 1952B UNIVERSAL COUNTER-TIMER
Print Date: DECEMBER 1975
Rev and Date: -----

C/E PAGE EFFECTIVITY

Page No.	Print Date
1	4/77
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7	6/79

- Page 2-1 Para 2-7C: Change both references to slo-blo fuses to fast-blo
 Page 4-4 Para 4-16: Change both references to slo-blo fuses to fast-blo.
 Page 4-10 Add the following after paragraph 4-41:
 4-41A + 5 Volt dc calibration
 4-41B Use the following procedure to calibrate the +5V dc power supply.
 a. Connect the test multimeter between +5V dc (positive end of C47 or J2-9) and ground.
 b. Adjust R108 for a reading between 4.8 and 5.0V dc.

- Page 5-2 Top drawing and parts list:
 Add the following items to the parts list:
 13; ; 419374; Decal, option; 1
 14; ; 406918; Timebase, 1952B-4010T; 1
 Add the following items to the drawing:
 The option decal is attached to the rear panel on the right corner.
 The timebase is installed on the right rear corner of the main pcb.
 Bottom drawing and parts list:
 Add or change the following items on the parts list:

- 4; ; 372458; Heatsink; 1952B-2004; 1
 5; ; 372482; Bracket, 1952B-2010; 2
 9; ; 331249; Thermo setting tape 3/8" x 5"; 2
 10; ; 393975; Decal, serial number (M00-800-555); 1

- Add the following items to the drawing:
 Item 9, is used to attach item 3 to item 1, with one strip above and one below the indicator opening.
 Item 10, is attached to the low center portion of the front panel.

- Page 5-3 Make the following changes to the drawing:
 Diode labeled "10" at top left of drawing: Renumber as "11" and reverse the cathode band.
 Diode labeled "11" at top left of drawing: Renumber as "10" and reverse the cathode band.
 Add variable resistor labeled 74 between the IC labeled 25 and the resistor labeled 56.
 Relabel the above resistor from 56 to 77.
 Add a capacitor labeled 67 below IC 32 in the lower left corner.
 Relabel resistor 51 between the large capacitors 4 and 5 as 49.
 Relabel resistor 54 at the bottom right center of the drawing as 78.
 Add a capacitor labeled 40 beneath the resistor relabel 78, and left of the resistor labeled 55.

- Change the items below to read as changed:
 3; C5; 392720; Capacitor 2200 μ F, 25V; 1
 5; C36; 182832; Capacitor 33 μ F, 10V; 1
 8; CR3 - CR6; 296509; Diode Bridge KBP02; 1
 10; 11 ; 203323; Diode 1N4448; 12

14; Q4; 269076; Transistor 2N2905; 1
 20; 13 ; 218396; Transistor 2N3904; 6
 40; 29 ; 369579; Capacitor .01 μ F, 50V; 3
 45; R7, R9, R10, R104; 170720; Resistor; 1/4W, 5%, CC, 2K7; 4
 51; 21 ; 148015; Resistor, 1/4W, 5%, CC, 820; 8
 54; R103; 193441; Resistor, 1/4W, 5%, CC, 180K; 1
 56; 24 ; 148007; Resistor, 1/4W, 5%, CC, 680; 4
 74; R108; 275735; Resistor, Trimpot 100 Ω ; 1
 76; C46; 277202; Capacitor, 43 pF, 500V; 1
 77; R3; 147967; Resistor, 1/4W, 5%, CC, 330; 1
 78; R82; 182212; Resistor, 1/4W, 5%, CC, 150K; 1
 21 ; Delete R104
 24 ; Delete R3
 29 C13, C22, C47

Page 5-4 Make the following changes to the drawing:

Add a variable resistor between R3 and U6 at the top left of the drawing.

Add a capacitor C46 below U29 at the lower left of the drawing.

Add a capacitor C47 next to R83 and beneath R82 at the bottom center of the drawing.

Page 5-5 Change the following items on the parts list:

9; CR1 - CR6; 203323; Diode 1N4448; 6

10; R2, R3, R5, R6, R8, R9; 147975; Resistor, 1/4W, 5%, CC, 390; 6

Delete R4, R7 and R10 from the reference designator drawing, then delete the corresponding item 10 locations on the parts list drawing.

Page 5-6 Change the following items on the parts list:

9; C1, C3; 441345; Capacitor; 1 μ F 250V; 2

14; ; 433334; Coaxial Cable Assy; 2

Page 5-7 Change the following items on the parts list:

11; CR1, CR2; 203323; 1N4448; 2

Page 5-8 Change the following items on the parts list:

2; ; 372565; 1952B-4002 Display PCB Assy; 1

3; ; 372581; 1952B-4003 Switch PCB Assy; 1

11; ; 449355; Pointer, Knob; 2

14; ; 312538; Washer; 1

28; ; 115808; Wire #22 Violet X 7" L; 1

33; ; 115790; Wire #22 Orange X2" L; 2

37; ; 175976; Sleeving 1"; 2

38; ; 110510; Nut 3/8 - 32 Hex; 2

Make the following changes to the parts drawing:

Delete the present item 33.

Change the unnumbered single pole switch on the rear panel to a double pole.

Connect one orange wire (new item 33) between the bottom connector added to the switch, and a connection point on the main pcb directly behind the black wire from the other side of the switch. Connect the second orange wire from the new center connector on the switch to a point on the pcb to the left of the other new wire.

Page 5-9 Change the following items on the parts list:

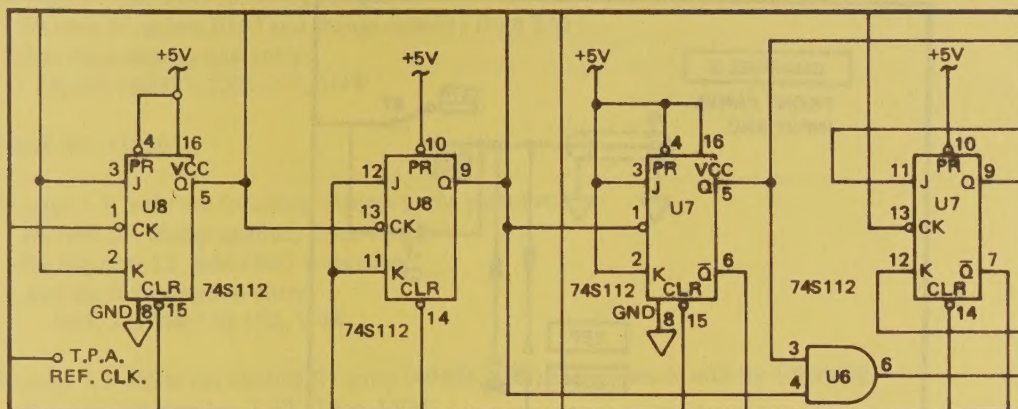
3; ; 152033; BNC Jacks; 2

9; ; 110668; Nut #2-56; 2

10; S3; 370122; Slide Switch; 1

14; ; 372441; Rear Panel 1952B-2013; 1

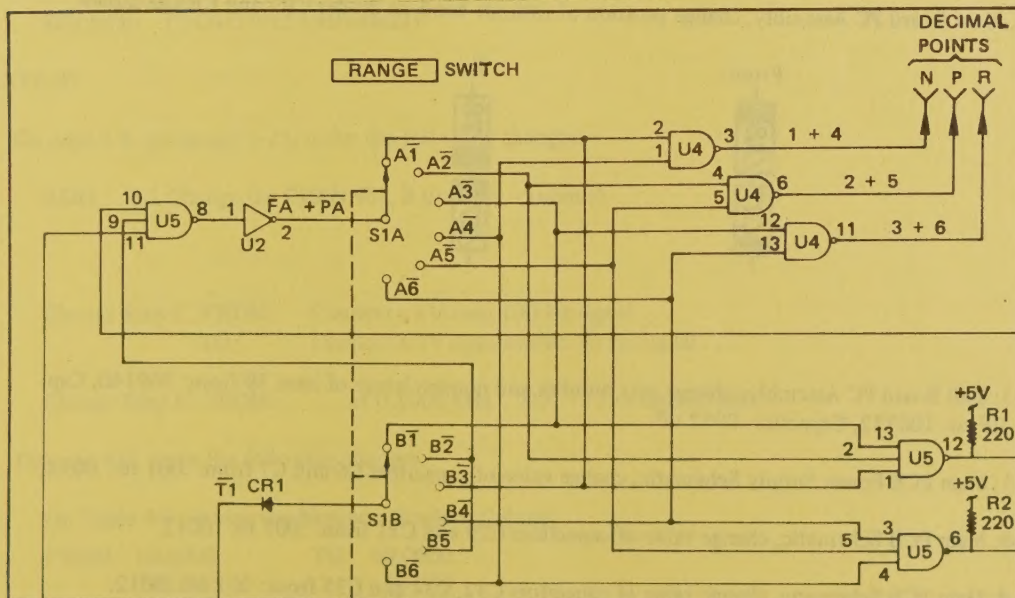
Add the connections to U7 and U8 as shown below:



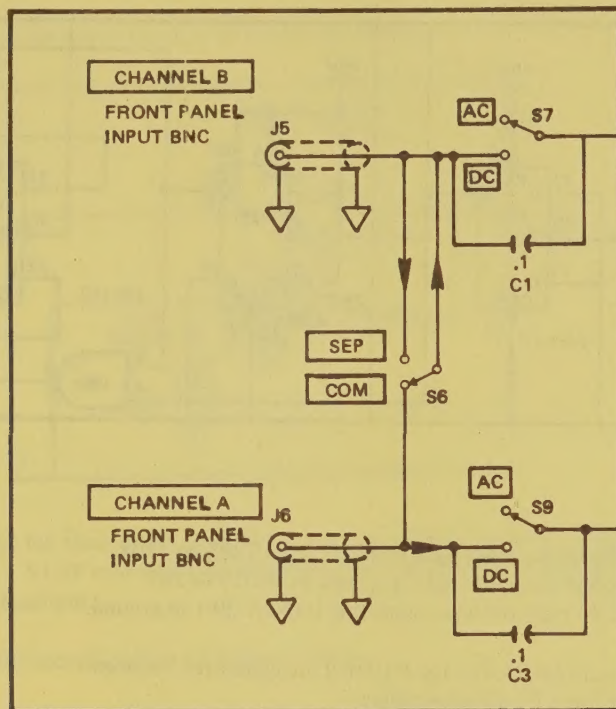
Page S-5 Change the value of R103 in the upper right quadrant from 220K to 180K.
Change the value of R104 in the upper right quadrant from 820 to 2K7.
Add a 43 pF capacitor C46 from the line connecting U30-3/U29-1 to ground.

Page S-6 Delete the three 390Ω resistors R4, R7 and R10 that are connected between ground and U4-13, U3-13 and U2-13 respectively.
Change the value of the cycle rate adjustment pot R14 from 10K to 25K.

Page S-7 Correct the range switch inputs as shown below.



Page S-8 Change the SEP-COM switch connections to those shown below:

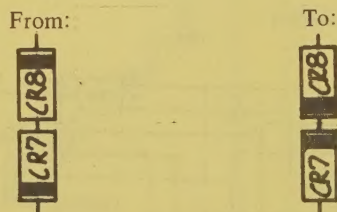


CHANGE #1-10972

On page 5-5, Display Board PCB Assembly, change part number of S4 from: 369421 to 380113.

CHANGE #2-10973

On page 5-4, Main Board PC Assembly, change position of cathode band on diodes CR7 and CR8 as shown below:



CHANGE #3

On page 5-3, Mail Board PC Assembly, change part number and nomenclature of item 39 from: 369140, Capacitor .001 uF to: 106732, Capacitor .0012 uF.

On page S-1, Main PCB Power Supply Schematic, change value of capacitors C6 and C7 from: .001 to: .0012,

On page S-3, Main PCB Schematic, change value of capacitors C29 and C31 from: .001 to: .0012.

On page S-4, Main PCB Schematic, change value of capacitors C32, C34 and C35 from: .001 to: .0012.

On page S-5, Main PCB Schematic, change value of capacitor C44 from: .001 to: .0012.

CHANGE #4–11318

On page 5-3, make the following changes to the parts list:

On item 54, delete R103 and change quantity from 2 to 1.

Add the following new entry:

R103; 160937; 220k $\pm 5\%$, 1/4W

CHANGE #5–11339

On page 5-3, make the following changes to the parts list:

On item 55, change quantity from 4 to 3.

On flag note 23, delete R83 from entry.

Add the following new entry:

R83; 325704; 130 $\pm 5\%$, 1/4W.

On page 5-5, delete the existing R1 entry (49484, 82 Ω) and replace it with the following:

R1; 325704; Resistor, 1/4W, 5%cc, 130;1.

On page 5-6, delete the existing R7–R10 entry (49484, 82 Ω) and replace it with the following:

R7–R10; 325704; Resistor, 1/4W, 5%cc, 130; 1.

On page S-3, change the value of R83 from 68 Ω to 130 Ω .

On page S-6, change the value of R1 from 82 Ω to 130 Ω . Change R14 from 10 k Ω to 25 k Ω .

On page S-8, change the value of resistors R7 through R10 from 82 Ω to 130 Ω .

CHANGE #6 – 11971

Rev.-M, Main Board PC Assembly (1952B-4001)

On page 5-3, make the following changes:

DELETE: 72/Q4/370155/Heatsink/1

ERRATA #1

On page 4-8, paragraph 4-35, make the following changes:

ADD: a.1 Change the CHANNEL B slope to – (minus)

Change Step C, FROM: Connect a 1V rms, 100 Hz signal . . .

TO: Connect a 1V squarewave, 10 Hz signal . . .

Change Step D, FROM: . . .of 0.1000 kHz TO: . . .of 0.0100 kHz

On page 4-9, make the following changes:

On Table 4-6, change the Numeric Readout Column

FROM: 10.0000	TO: 50.0000
10.000	50.000
10.00	50.00
.0100	.0500
.010	.050
.01	.05

FROM: *The accuracy of the readout is dependent on the frequency accuracy of the 100 Hz signal source.

TO: *The accuracy of the readout is dependent on the frequency accuracy of the 10 Hz signal source, the symmetry of the waveform and the Time Interval Accuracy Specification. (See section one of this manual).

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Section 1

Introduction & Specifications

1-1 INTRODUCTION

1-2 The Fluke Model 1952B is a universal, DC to 80 MHz, counter/timer capable of making frequency, frequency ratio, period, time interval, gateable totalize, and self check measurements. Each measurement mode and one of six associated ranges are individually selectable using the front panel FUNCTION and RANGE switches.

1-3 Front panel features include individual trigger level adjustments for the CHANNEL A and B input signals, switch selection of a continuous or single measurement cycle, and a seven digit display.

1-4 A self check mode provides a convenient method of verifying the overall operation of the 1952B. In this mode, the counter is configured such that a frequency measurement is made using the 100 kHz output of the internal frequency standard as an unknown input. A valid readout for each setting of the range switch verifies proper overall operation.

1-5 The trigger level controls allow the operator to manually define the conditions under which the individual CHANNEL A and B inputs will accept an input signal as a trigger. Switches are used to select x1 or x10 attenuation, ac or dc coupling, and + or - slope triggering. A continuously variable trigger level control is used to set the + or - dc threshold voltage which the input signal must exceed before being accepted as an input signal. A PRESET position on the trigger level adjustment sets the threshold to 0 V dc. Two light emitting diode (LED) Status Indicators operate in conjunction with the variable trigger level to simplify the task of establishing proper triggering.

1-6 A measurement can be continuously repeated at an adjustable rate, or a front panel manual RESET command can be selected to initiate each measurement cycle.

1-7 The front panel display on the standard instrument consists of a seven digit readout plus six range annunciators (measurement units indicators). The display is equipped with leading zero suppression for all decades except the least significant decade (LSD). Decimal point location, if any, is fixed according to the selected FUNCTION and RANGE, and is supplemented, when necessary,

by the illumination of one or more of the measurement units indicators.

1-8 A factory installed option (-03) is available which provides a temperature compensated crystal oscillator (TCXO) and an eight digit display for higher measurement accuracy and resolution.

1-9 The model 1952B is designed as a bench-top instrument. However, by installing the Accessory Rack Mounting Kit (part no. M00-200-614) the 1952B can be mounted in a standard 19 inch equipment rack. Input power requirements are 115 or 230 V ac $\pm 10\%$, 50 to 400 Hz, 20 Watts.

TABLE 1-1 - AVAILABLE OPTION

OPTION	DESCRIPTION	INSTALLATION	
		FACTORY	FIELD
-03	-03 TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR (TCXO) AND 8 DIGIT DISPLAY	X	-

1-10 SPECIFICATIONS

Operating Modes

FREQUENCY

Range..... DC to 80 MHz (dc coupled)
5 Hz to 80 MHz (ac coupled)

Gate Time..... 0.1 ms to 10 s in 6 decade steps

Resolution..... 0.1 Hz at 10 s gate time to 10 kHz at 0.1 ms gate

Accuracy..... ± 1 count $\pm$ timebase accuracy

Readout..... kHz or MHz automatically displayed with decimal point

RATIO

Displays..... f_1/f_2 where f_1 and f_2 are applied at the two input channels, A and B

Range f_1 DC to 80 MHz (dc coupled)
5 Hz to 80 MHz (ac coupled)

f_2 1 kHz to 10 MHz

Accuracy..... ± 1 count of signal on input A.
 $\pm$ trigger error of signal on input B*

PERIOD

Range.....	DC to 10 MHz (dc coupled) 5 Hz to 10 MHz (ac coupled)
Periods averaged.....	1 period to 10^5 periods
Frequency counted.....	100 kHz
Resolution.....	0.1 ns at 10^5 periods to 10 us at 1 period
Accuracy.....	± 1 count $\pm$ timebase accuracy, $\pm$ trigger error of signal on input A*
Readout.....	ms or us automatically displayed with decimal point

TIME INTERVAL

Range.....	0.1 us to 10^7 s (with 7 digit display) 0.1 us to 10^8 s (with 8 digit display)
Input.....	Channels A and B; common or separate
Resolution.....	0.1 us to 10 ms in 6 decade steps
Accuracy.....	± 1 count $\pm$ timebase accuracy $\pm$ trigger error**

* Trigger error is less than $\pm 0.3\%$ - periods averaged for signals with better than 40 dB S/N ratio and greater than 100 mV rms amplitude.

** Trigger error is less than ± 0.0025 V/Signal Slope (V/us) in us.

TOTALIZING

Range.....	DC to 80 MHz (dc coupled)
Capacity.....	10^7 standard, up to 10^8 with 8 digit display

SELF CHECK..... A timebase-derived 100 kHz signal is internally connected to the Channel A preamplifier output.

Input Signals

SENSITIVITY

Input A or B.....	Sinewave: 50 mV rms from dc to 50 MHz, decreasing to 75 mV rms at 80 MHz Pulse: 100 mV pulse amplitude with minimum pulse width of 20 ns.
-------------------	--

IMPEDANCE

Input A or B.....	1 M ohm in parallel with 30 pF
-------------------	--------------------------------

ATTENUATOR

Input A and B only..... Sensitivity is decreased by a factor of 10 in the X10 position.

TRIGGER SLOPE

Input A and B only..... Front panel slide switch selects positive or negative slope triggering.

TRIGGER LEVEL

Input A and B only..... Front panel control has ± 1 V range when attenuator is in X1 position and ± 10 V in the X10 positions. Preset position is fully counter-clockwise.

OVERLOAD CAPABILITY

Input A or B..... 150 V rms to 1 kHz (decreasing to 5 V rms at 80 MHz)
DC + Peak ac must not exceed 150 V

Output Signal

Marker Output..... A TTL Compatible (5 Volt) output is available for the duration of a time interval measurement at the rear panel BNC connector.

Time Base

INTERNAL

	Standard	Option -03
Frequency.....	10.00 MHz	10.00 MHz
Aging Rate.....	$< \pm 5 \times 10^{-7}/\text{mo}$	$< \pm 3 \times 10^{-7}/\text{mo}$
Temperature Stability		
20°C to 30°C.....	$< \pm 2 \times 10^{-6}$ typical	$\pm 5 \times 10^{-7}$ typical
0°C to 50°C.....	$< \pm 5 \times 10^{-6}$	$< \pm 2 \times 10^{-6}$
Line Voltage		
For $\pm 10\%$ change.....	$< \pm 1 \times 10^{-7}$	$< \pm 1 \times 10^{-7}$

EXTERNAL

Frequency Required.....	10 MHz
Sensitivity.....	100 mV minimum
Impedance.....	1 M ohm, 15 pF

General

DISPLAY.....	7 digit LED display incorporating 0.27" high, seven segment characters. Up to 8 digits optionally available. Full leading zero suppression.
CYCLE RATE.....	When in the "CONT" mode, the time interval between successive measurements can be varied between 0.2 and 2.0 seconds by means of a CYCLE RATE control. RESET button clears display and activates a new measurement.
RESET.....	In "TRIG" mode the readings may be updated by pushing the RESET button.
POWER REQUIREMENTS.....	50, 60, 400 Hz; 115/230 V $\pm$ 10% (100 V operation available) 25 Watts
DIMENSION.....	2.94" high, 12.96" wide and 9.95" deep. (7.5 cm X 32.9 cm X 25.3 cm) See Figure 1-1.
WEIGHT.....	8 pounds (3.63 kg)

Environmental

STORAGE TEMPERATURE.....	-40°C to + 75°C
OPERATING TEMPERATURE.....	0°C to + 50°C

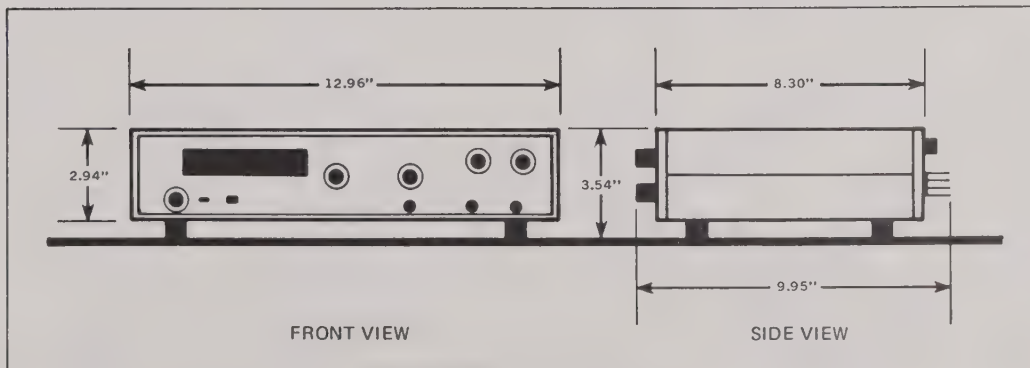


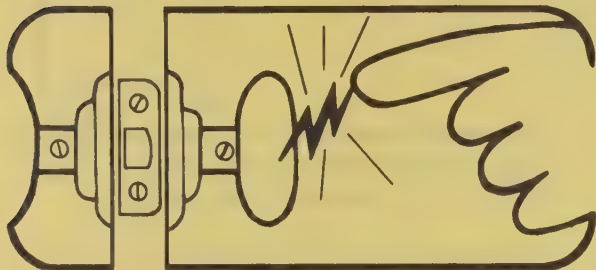
Figure 1-1. OUTLINE DRAWING



static awareness



A Message From
John Fluke Mfg. Co., Inc.



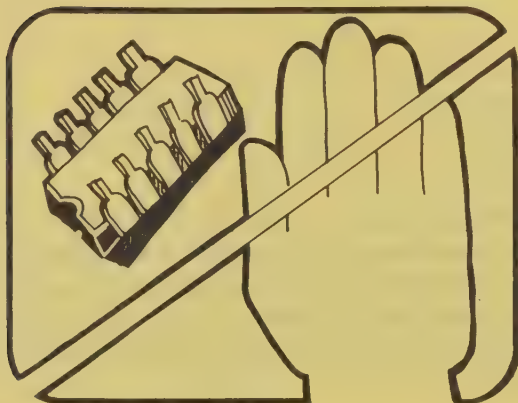
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol



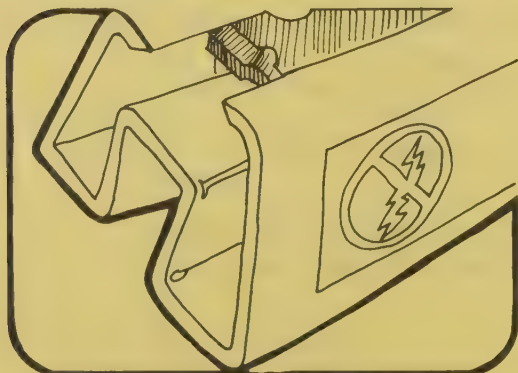
The following practices should be followed to minimize damage to S.S. devices.



1. MINIMIZE HANDLING



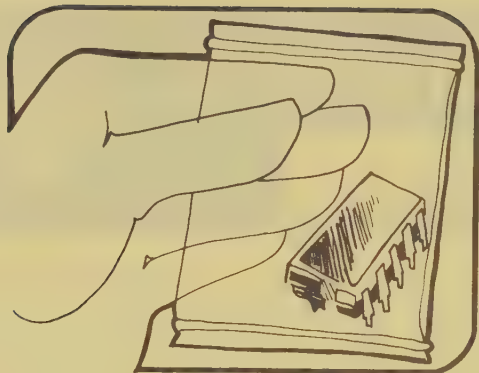
3. DISCHARGE PERSONAL STATIC
BEFORE HANDLING DEVICES



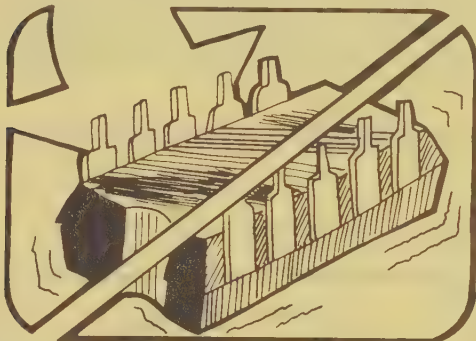
2. KEEP PARTS IN ORIGINAL CONTAINERS
UNTIL READY FOR USE.



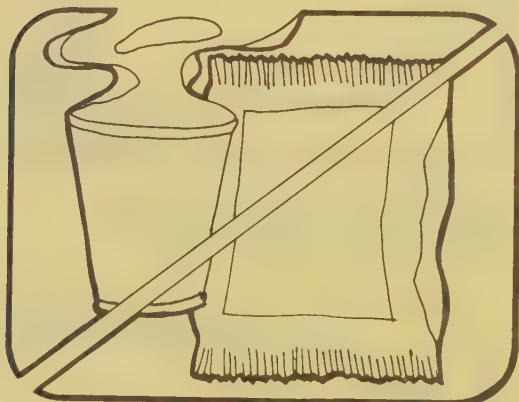
4. HANDLE S.S. DEVICES BY THE BODY



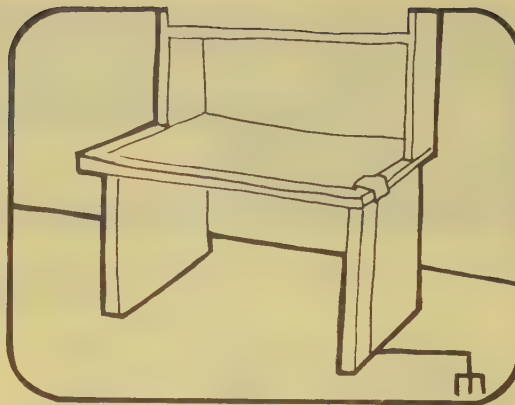
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYRAFOAM IN WORK AREA



8. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

9. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

10. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Bag Size
453522	6" x 8"
453530	8" x 12"
453548	16" x 24"
454025	12" x 15"

Section 2

Operating Instructions

2-1 INTRODUCTION

2-2 This section of the manual contains information regarding installation and operation of the Model 1952B Counter. It is recommended that the contents of this section be read and understood before any attempt is made to operate the counter.

2-3 SHIPPING INFORMATION

2-4 The Model 1952B is packaged and shipped in a shock resistant container. Upon receipt of the equipment, a thorough inspection should be made to reveal any possible shipping damage. Special instructions for inspection and claims are included in the shipping carton.

2-5 If reshipment of the equipment is necessary, the original container should be used. If the original container is not available, a new container can be obtained from the John Fluke Mfg. Co., Ltd. Please reference the equipment model number when requesting a new shipping container.

2-6 INPUT POWER

2-7 The Model 1952B can be operated from a 115 or 230 V ac, 48 to 440 Hz power line (A 100/200 V ac version is available on request). Before connecting the equipment to primary power, check and, if necessary, set the instrument to operate at the local line voltage as follows:

- a. Locate the input power selection switch on the rear panel of the 1952B.
- b. Set the slide switch so that the desired voltage, 115 or 230, appears in the slide aperture.
- c. Install the proper fuse (i.e. 1A slo-blo for 115 V ac and 0.5 A slo-blo for 230 V ac) in the rear panel fuse holder.

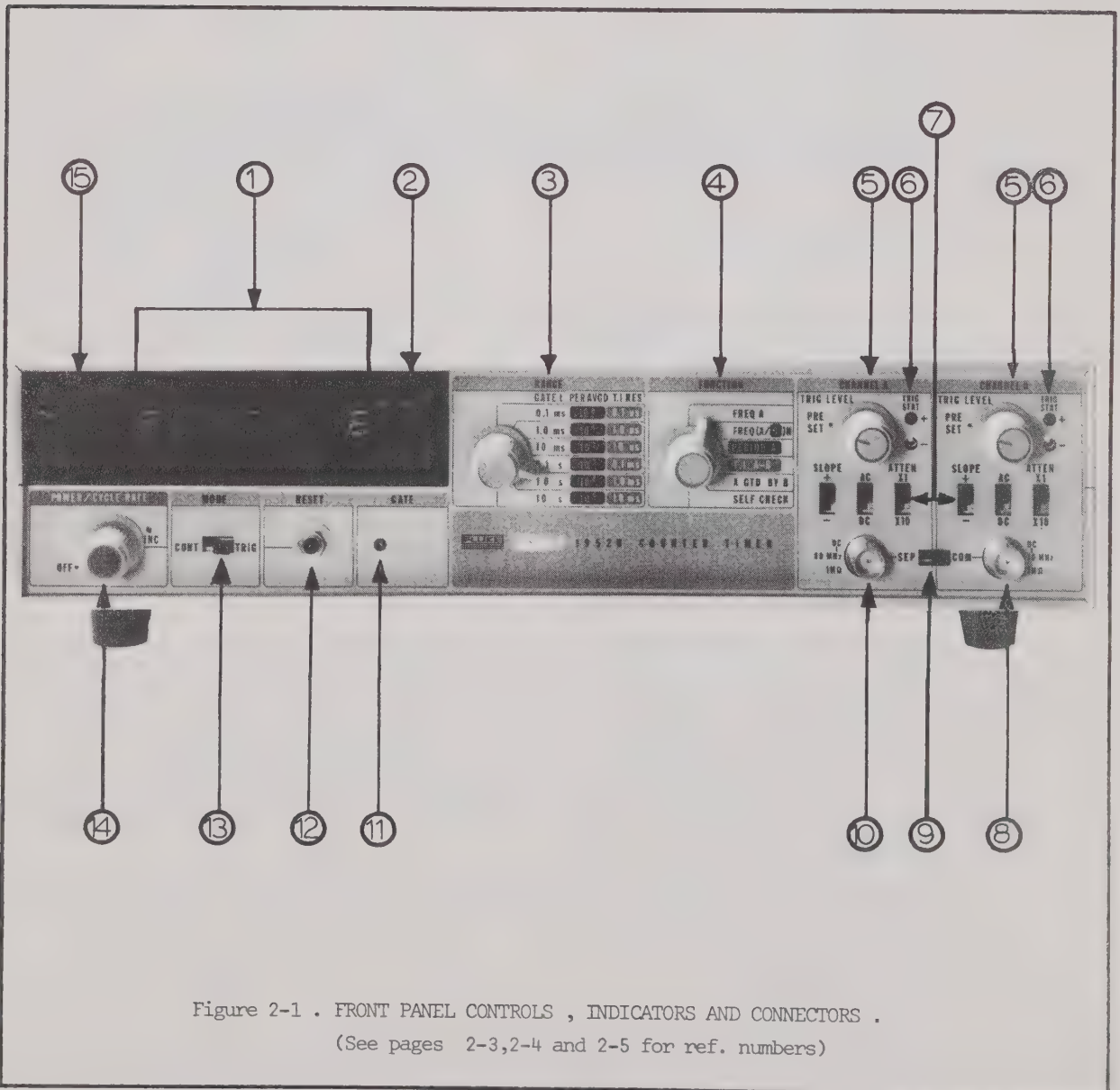
2-8 RACK INSTALLATION

2-9 The 1952B is designed for bench-top use or for installation in a standard 19 inch

equipment rack using the optional Accessory Rack Mounting Kit (part number M00-200-614).

2-10 OPERATING FEATURES

2-11 The function and location of all front panel controls, indicators and connectors are shown in Figure 2-1 and all rear panel controls, indicators and connectors are shown in Figure 2-2.



REF. NO.	NAME	FUNCTION
1	Digital Display	Displays a seven digit readout of the counter measurement. The position of the RANGE and FUNCTION switches determine the location of the decimal point on the display. All decades are capable of displaying from 0 through 9.
2	Measurement Units	Displays a frequency or time multiplier necessary to properly define the value of the measurement readout. The multiplier displayed depends on the position of the RANGE and FUNCTION switches.
3	RANGE Switch	Selects one of six ranges for the selected operating function. GATE t..... Gate time ranges for frequency modes. PER.AVGD..... Number of periods averaged in PERIOD A mode. T.I, RES..... Resolution for T.I, A-B mode.
4	FUNCTION Switch	Selects the desired operating mode. FREQ. A..... Measures frequency of the CHANNEL A input signal. FREQ.(A/B)N..... Measures the frequency ratio of the CHANNEL A and B inputs. PERIOD A..... Measures the period of the CHANNEL A input signal. The number of periods averaged (10^0 through 10^5) are selected by the setting of the RANGE switch. T.I. A-B..... Measures the time interval between a start input signal at CHANNEL A and a stop input signal at CHANNEL B. A GTD. BY B..... Measures the number of events which occur on the CHANNEL A input when an enable signal is applied to the CHANNEL B input. The RANGE switch is not effective in this mode. SELF CHECK..... All inputs are disabled and an internally generated 100 kHz signal is counted and displayed.
5	Trigger Level Adjust	Sets the dc trigger level for the CHANNEL A/B input signal. With the control set to the PRESET position (maximum ccw) the trigger level is set to zero volts. Switched out of the detent position, the control can be set to cause triggering at positive or negative threshold voltages.

REF NO.	NAME	FUNCTION
6	Status Indicators + and - (CHANNEL A/B)	Two light emitting diodes (LED's) which illuminate on a mutually exclusive basis to indicate that the input signal is above or below the set trigger level. The illumination pattern is alternately reversed as the input signal passes above and below the trigger level threshold.
7	CHANNEL A and B Input Signal Conditioners	Slide switches which select the trigger Slope, Coupling and Attenuation for the respective CHANNEL A and B input signals. Slope..... Selects the leading or trailing edge slopes (+ or -) of the input signal for use in triggering the counter. Coupling..... Selects either direct DC coupling or capacitive AC coupling for the input signal. Attenuators..... Selects x1 or x10 attenuation of the input signal. In the x10 position the input sensitivity is reduced by a factor of 10.
8	CHANNEL B Input Connector	A BNC connector used to connect the CHANNEL B input signal to the counter.
9	SEP - COM Switch	A slide switch which electrically isolates or separates the CHANNEL A and B input signals in the SEP position, and electrically connects the inputs in the COM position.
10	CHANNEL A Input Connector	A BNC connector used to connect the CHANNEL A input signal to the counter.
11	GATE Indicator	An LED which illuminates to indicate that the counter is executing a measurement cycle.
12	RESET Switch	Momentary depression of the button resets the display to zero and initiates a new measurement.
13	CONT-TRIG Switch	Selects the internal (CONT) or external (TRIG) trigger method for initiating a new measurement. CONT..... Measurements are made on a continuous basis, one after another, separated by time delays dependent on the setting of the CYCLE RATE control. TRIG..... Measurements are initiated by a RESET pulse

		generated by momentarily depressing the RESET button.
14	CYCLE RATE	Determines the amount of time between successive measurements when the CONT - TRIG switch is in the CONT position. Also turns off the entire instrument in the CCW extreme (POWER OFF).
15	OVERFLOW Indicator	Illuminates to indicate that the counter has exceeded its total display capacity (overflowed).

2-12 OPERATING NOTES

2-13 The following paragraphs describe various conditions which should be considered before operating the Model 1952B Counter.

2-14 AC Line Connection

2-15 The input power cord is a three-pin polarized connector which permits connection to any of the power line voltages described in paragraph 2-6. Ensure that the offset pin is connected to a high quality earth ground. The 1952B Counter is energized by means of the front panel POWER/CYCLE RATE switch.

2-16 A and B Inputs

2-17 Input channels A and B are functionally similar. With the attenuators in the X1 position, the input impedance of each channel is 1 M ohm in parallel with 30 pF for signals less than 1 volt peak-to-peak, and decreases to 10 k ohm for signals that exceed 1 volt peak-to-peak. With the attenuators in the X10 position, the input resistance is 1 M ohm for all input signal levels.

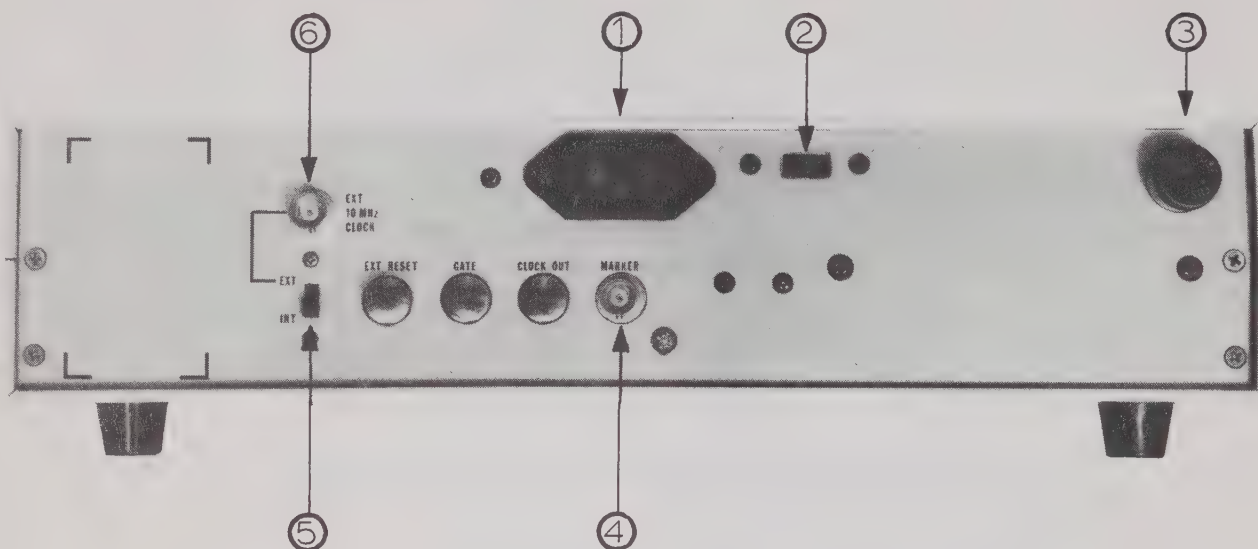
2-18 SEP - COM Switch

2-19 The SEP-COM (separate-common) switch is used to isolate the A and B inputs when the switch is in the SEP position, or to electrically connect the two inputs in the COM position. The switch is normally left in SEP position except for time interval measurements using a single input signal. With the switch in the COM position, CHANNEL A is used to establish the start trigger level conditions and the CHANNEL B is used to establish the stop trigger level conditions.

CAUTION!

If separate signal sources are to be connected to the A and B input, the SEP-COM switch should be set to the SEP position. Otherwise the outputs of the signal sources will be shorted together.

Figure 2-2. REAR PANEL CONTROLS , INDICATORS AND CONNECTORS .



REF NO.	NAME	FUNCTION
1	Power Input Connector	Provides the means of connecting the instrument through the power cord to line power.
2	115/230 Power Select Switch	Provides rear panel selection of 115 or 230 V ac input power.
3	FUSE	Protects the ac input section of the power supply.
4	MARKER Connector	Provides for external connection to the Marker output signal. This signal is used to modulate the Z axis on an oscilloscope while displaying the input signal. The result is an intensified zone which displays the start to stop interval for a time interval measurement.
5	Clock Select Switch	Selects the internal or external clock for use as the counter time base. INT..... Selects the internal 10 MHz clock. EXT..... Selects the external clock input signal connected to the EXT 10 MHz clock connector.
6	EXT 10 MHz Connector	Provides for the connection of an external 10 MHz clock input signal. The minimum input level requirement is 150 mV and the input impedance is 1 M ohm.

2-20 Trigger Levels

2-21 The front panel trigger level controls provided for each CHANNEL A and B input consist of three slide switches; two LED Status Indicators and a manual Trigger Level Adjust. The slide switches condition the input signal before it is used to trigger the counter by selecting the desired trigger slope (+ or -), coupling (AC or DC) and attenuation (x1 or x10). The Trigger Level Adjust is then used to set the dc threshold of an internal trigger circuit and thereby define the trigger level for the channel input signal. The range of the trigger level control is continuously variable from + 1 to - 1 V dc with the attenuator switch in the x1 position. Selecting the x10 attenuator increases the trigger level voltage range by a factor of 10. When the trigger level control is turned CCW to the PRESET detent, the trigger level is set to 0 V dc. The two Status Indicators provide a convenient method of determining the effective operating range of the trigger level control for a given input signal. Assuming a sinewave input is used, both LED's are illuminated to an equal intensity when the trigger level control is adjusted to trigger at 0 V dc. For non-symmetrical input signals triggering occurs when both LED's are illuminated regardless of intensity. Very narrow low frequency pulses may not illuminate the Status Indicators even though proper triggering occurs.

2-22 MARKER Output

2-23 In the Time Interval mode, a pulse is generated at the rear panel MARKER output connector to provide an indication of the actual time interval being measured. The width of the MARKER pulse is variable depending on the time interval of the signal being measured and the trigger level settings for CHANNELS A and B (Start and Stop). When the measured input signal is fed to the vertical input of an oscilloscope, the MARKER pulse can be used to modulate the Z axis of the scope and cause the measured portion of the input signal to be intensified. Using this technique, the thresholds for the A and B (Start and Stop) Trigger Levels can be individually adjusted for precise time interval measurements.

2-24 In the Frequency A mode, the Marker pulse can be used to precisely set the A trigger level. However, the Channel B Trigger Level controls must also be adjusted to reset the Marker generator. This is accomplished by setting the SEP - COM switch to the COM position and adjusting the B Trigger Level so that the intensified zone is terminated shortly after it begins. Adjust the Channel A Trigger Level to the desired position.

2-25 OPERATION

2-26 Turn-On Procedure

2-27 Use of the following procedure is suggested for initial turn-on of the 1952B Counter:

- a. Connect the counter to the ac power line. (See paragraph 2-6).
- b. Turn the POWER/CYCLE RATE switch clockwise and out of the power OFF detent. The front panel display should illuminate.

2-28 Operating Modes

2-29 The following paragraphs describe the self check, frequency, ratio, period, time interval and totalize functions and the procedures necessary to operate the 1952B in each mode.

2-30 SELF CHECK

2-31 The SELF CHECK function is used to verify the overall operation of Model 1952B. The Frequency of a 100 kHz clock, derived from the 10 MHz oscillator, is measured to produce a predictable readout for each setting of the GATE t switch.

2-32 Use the following procedure to operate the Model 1952B in the SELF CHECK mode:

- a. Turn the CYCLE RATE switch clockwise out of the power OFF detent.
- b. Set the rear panel Clock Select Switch to the INT (internal) position.
- c. Set the FUNCTION switch to the SELF CHECK position.
- d. Set the MODE switch to the CONT position.
- e. Set the CYCLE RATE control for the desired display period.
- f. Refer to Table 2-1 and verify the display readout for each GATE t setting of the RANGE switch.

Table 2-1 DISPLAY READOUT FOR SELF CHECK MODE

GATE t SETTINGS	NUMERIC READOUT
0.1 ms	10
1.0 ms	100
10 ms	1000
0.1 s	10000
1.0 s	100000
10 s	1000000

2-33 FREQUENCY

2-34 Standard frequency measurements from 0 to 80 MHz are made using the FREQUENCY A operating mode. The GATE times available for each frequency measurement range from 0.1 ms to 10 s in power of ten steps and are selected by the setting of the RANGE switch. The RANGE switch is set to provide optimum resolution of the displayed frequency.

2-20 Trigger Levels

2-21 The front panel trigger level controls provided for each CHANNEL A and B input consist of three slide switches, two LED Status Indicators and a manual Trigger Level Adjust. The slide switches condition the input signal before it is used to trigger the counter by selecting the desired trigger slope (+ or -), coupling (AC or DC) and attenuation (x1 or x10). The Trigger Level Adjust is then used to set the dc threshold of an internal trigger circuit and thereby define the trigger level for the channel input signal. The range of the trigger level control is continuously variable from +1 to -1 V dc with the attenuator switch in the x1 position. Selecting the x10 attenuator increases the trigger level voltage range by a factor of 10. When the trigger level control is turned CCW to the PRESET detent, the trigger level is set to 0 V dc. The two Status Indicators provide a convenient method of determining the effective operating range of the trigger level control for a given input signal. Assuming a sinewave input is used, both LED's are illuminated to an equal intensity when the trigger level control is adjusted to trigger at 0 V dc. For non-symmetrical input signals triggering occurs when both LED's are illuminated regardless of intensity. Very narrow low frequency pulses may not illuminate the Status Indicators even though proper triggering occurs.

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2-23 In the Time Interval mode, a pulse is generated at the rear panel MARKER output connector to provide an indication of the actual time interval being measured. The width of the MARKER pulse is variable depending on the time interval of the signal being measured and the trigger level settings for CHANNELS A and B (Start and Stop). When the measured input signal is fed to the vertical input of an oscilloscope, the MARKER pulse can be used to modulate the Z axis of the scope and cause the measured portion of the input signal to be intensified. Using this technique, the thresholds for the A and B (Start and Stop) Trigger Levels can be individually adjusted for precise time interval measurements.

2-24 In the Frequency A mode, the Marker pulse can be used to precisely set the A trigger level. However, the Channel B Trigger Level controls must also be adjusted to reset the Marker generator. This is accomplished by setting the SEP - COM switch to the COM position and adjusting the B Trigger Level so that the intensified zone is terminated shortly after it begins. Adjust the Channel A Trigger Level to the desired position.

2-25 OPERATION

2-26 Turn-On Procedure

2-27 Use of the following procedure is suggested for initial turn-on of the 1952B Counter:

- a. Connect the counter to the ac power line. (See paragraph 2-6).
- b. Turn the POWER/CYCLE RATE switch clockwise and out of the power OFF detent. The front panel display should illuminate.

2-28 Operating Modes

2-29 The following paragraphs describe the self check, frequency, ratio, period, time interval and totalize functions and the procedures necessary to operate the 1952B in each mode.

2-30 SELF CHECK

2-31 The SELF CHECK function is used to verify the overall operation of Model 1952B. The Frequency of a 100 kHz clock, derived from the 10 MHz oscillator, is measured to produce a predictable readout for each setting of the GATE t switch.

2-32 Use the following procedure to operate the Model 1952B in the SELF CHECK mode:

- a. Turn the CYCLE RATE switch clockwise out of the power OFF detent.
- b. Set the rear panel Clock Select Switch to the INT (internal) position.
- c. Set the FUNCTION switch to the SELF CHECK position.
- d. Set the MODE switch to the CONT position.
- e. Set the CYCLE RATE control for the desired display period.
- f. Refer to Table 2-1 and verify the display readout for each GATE t setting of the RANGE switch.

Table 2-1 DISPLAY READOUT FOR SELF CHECK MODE

GATE t SETTINGS	NUMERIC READOUT
0.1 ms	10
1.0 ms	100
10 ms	1000
0.1 s	10000
1.0 s	100000
10 s	1000000

2-33 FREQUENCY

2-34 Standard frequency measurements from 0 to 80 MHz are made using the FREQUENCY A operating mode. The GATE times available for each frequency measurement range from 0.1 ms to 10 s in power of ten steps and are selected by the setting of the RANGE switch. The RANGE switch is set to provide optimum resolution of the displayed frequency.

2-35 Use the following procedure to operate the Model 1952B in the FREQ A mode:

- a. Turn the CYCLE RATE switch clockwise out of the POWER OFF detent.
- b. Set the FUNCTION switch to the FREQUENCY A position.
- c. Set the MODE switch to the CONT position.
- d. Connect the input signal to be measured to the CHANNEL A Input Connector.
- e. Adjust the CHANNEL A Trigger Level Adjust to establish the desired trigger conditions. Proper triggering occurs when the + and - Status Indicators are both illuminated.
- f. Adjust the CYCLE RATE control for the desired display period.
- g. Obtain optimum resolution of the frequency displayed by selecting the proper GATE t setting on the RANGE switch.

2-36 RATIO

2-37 In the FREQ (A/B)N mode the frequency ratio of two input signals A and B can be measured. The resolution of the measurement can be increased by the factor N in decade steps by changing the setting of the RANGE Switch. Optimum resolution is obtained by ensuring that the higher frequency is used for the CHANNEL A input.

2-38 Since a decimal point is not displayed in the FREQ (A/B)N mode, its location is determined by noting the exponent of the PER.AVG D range switch setting and, starting to the right of the least significant digit on the display, shifting the decimal point that many places to the left.

2-39 Use the following procedure to operate the Model 1952B in the ratio mode:

- a. Turn the CYCLE RATE switch clockwise out of the POWER OFF detent.
- b. Set the FUNCTION switch to FREQ (A/B)N.
- c. Set the MODE switch to the CONT position.
- d. Set the SEP - COM switch to the SEP position.
- e. Connect the higher frequency to be measured to the CHANNEL A input.
- f. Connect the lower frequency to the CHANNEL B Input Connector.
- g. Rotate the CHANNEL A and B Trigger Level Adjusts to establish the desired trigger conditions. Proper triggering occurs when both Status Indicators are alternately illuminated.

- h. Adjust the CYCLE RATE control for the desired display period.
- i. If necessary, resolution of the displayed ratio is increased by advancing the RANGE switch in a clockwise direction.
- j. Locate the decimal point using the method described in the previous paragraph.

2-40 PERIOD

2-41 The period function is used to make single or multiple period average measurements for input frequencies up to 10 MHz. This mode is intended for use with low frequencies where maximum resolution is desired. For example, if the 10^0 PER range is selected and an input frequency of 1 Hz is applied to CHANNEL A input, the display will read 1000.00 ms. Switching the RANGE switch to the 10^1 PER AVGD position will cause the display to read 1000.000 ms. The selected setting of the RANGE switch indicates, in powers of ten, the number of periods of the input signal which are sampled to produce a final display.

2-42 Use the following procedure to operate the Model 1952B in the period average mode:

- a. Turn the CYCLE RATE control clockwise out of the POWER OFF detent.
- b. Set the FUNCTION switch to PERIOD A.
- c. Set the MODE switch to the CONT position.
- d. Set the SEP - COM switch to SEP.
- e. Connect the frequency to be measured to the CHANNEL A Input Connector.
- f. Adjust the CHANNEL A Trigger Level Adjust to ensure proper triggering.
- g. Adjust the CYCLE RATE control for the desired display period.
- h. Using the RANGE switch select the PER AVGD setting which provides optimum resolution.

2-43 TIME INTERVAL

2-44 In the time interval function, accurate time measurements can be made between the occurrence of two separate input signals or between two points on a single input signal. The trigger level and slope for the start input is detected using CHANNEL A and the stop input is detected using CHANNEL B. When a single input signal is used to provide both the start and stop events the SEP - COM switch is set in the COM position so that both CHANNELS A and B receive the same signal. The SEP - COM switch is set to the SEP position when the start and stop input signals are available as separate input signals.

2-45 Accurate pulse width, rise time and fall time measurements can be made using the time interval function. However, their accuracy depends on the start and stop trigger levels being set

to occur at precise voltage levels of the input signal. These levels can be visually set using an oscilloscope to display the input signal while modulating the Z axis scope input with the Marker output signal available at the rear of the 1952B. The measured time interval appears as an intensified zone on the scope trace and can be adjusted using the CHANNEL A and B Trigger Level controls. Refer to MARKER output discussion given earlier in this section under Operating Notes.

2-46 Use the following procedure to operate the Model 1952B in the time interval function:

- a. Turn the CYCLE RATE control clockwise out of the POWER OFF detent.
- b. Set the CONT - TRIG switch to the CONT position.
- c. Set the FUNCTION switch to T.I. A-B.
- d. Set the SEP - COM switch to the SEP position if separate start/stop inputs are used, or to COM if the start/stop inputs are derived from a single input signal.
- e. If separate input signals are used, connect the start signal to the CHANNEL A input and the stop signal to the CHANNEL B input. If a single input is used connect it to the CHANNEL A input.
- f. Adjust the CHANNEL A and B Trigger Levels to establish the desired start/stop trigger points. Use the MARKER output pulse in conjunction with an oscilloscope to establish precise trigger levels.
- g. Adjust the CYCLE RATE control for the desired display period.
- h. Using the RANGE switch, select the T.I. RES setting which provides the desired resolution.

2-47 TOTALIZING

2-48 In the A GTD.BY B function the Model 1952B can be used as a gateable totalizer. Each triggerable event which occurs on the CHANNEL A input is accumulated or totalized while a gate pulse is present at the CHANNEL B input. The CHANNEL B gate pulse assumes an active high state when the associated slope switch is set to the positive (+) position and an active low state when the slope switch is set to the negative (-) position. In this mode the RANGE switch is not functional.

2-49 Use the following procedure to operate the Model 1952B in the totalize function:

- a. Turn the CYCLE RATE control clockwise out of the POWER OFF detent.
- b. Set the FUNCTION switch to the A GTD.BY B position.
- c. Set the SEP - COM switch to the SEP position.
- d. Connect the signal to be counted or totalized to the CHANNEL A Input Connector.

- e. Connect the gate pulse to the CHANNEL B Input Connector.
- f. Adjust the CHANNEL A and B Trigger Level Adjust to ensure proper triggering. The counter will totalize event inputs on CHANNEL A as long as the CHANNEL B input is at an active level. In this mode the display will reset only when the manual RESET is activated.

NOTE!

If no input signal to channel B is required or available, the gating of the accumulator can be manually controlled by the CHANNEL B SLOPE switch. Turn the CHANNEL B TRIGGER LEVEL control fully cw. Setting the SLOPE switch for CHANNEL B to - will now gate the accumulator, and the 1952B will totalize. Setting it back to + will inhibit the accumulator, and the totalizing will halt. To resume totalizing, set the SLOPE switch to - again; to start over from zero, momentarily press the RESET switch.

Section 3

Theory of Operation

3-1 INTRODUCTION

3-2 This section of the manual contains an overall functional description followed by a detailed block diagram analysis of the Model 1952B Digital Counter-Timer. Simplified block diagrams and timing diagrams are included, as necessary, to supplement the text.

3-3 OVERALL FUNCTIONAL DESCRIPTION

3-4 The Fluke Model 1952B, as shown in the simplified block diagram of Figure 3-1, is a

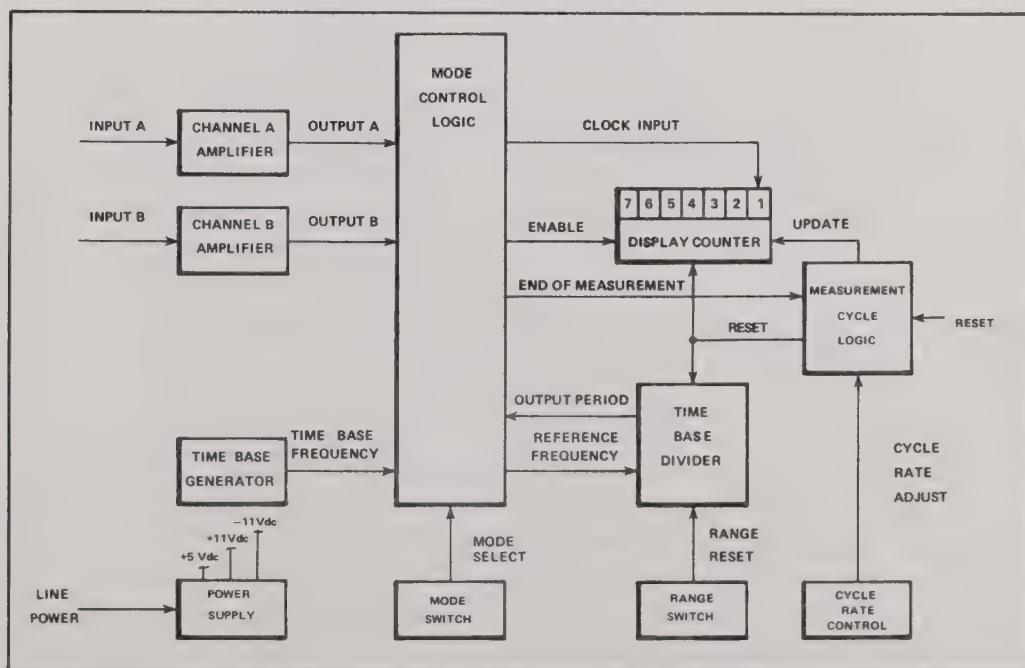


Figure 3-1 . MODEL 1952B , SIMPLIFIED BLOCK DIAGRAM .

universal counter/timer capable of making frequency, frequency ratio, period average, time interval and totalize measurements. Each measurement mode and six associated ranges are individually selectable from the front panel. Separate CHANNEL A and B inputs provide the trigger levels controls necessary to condition input frequencies from 0 to 80 MHz. All measurements are displayed on a seven decade LED display along with range annunciators and decimal point, when applicable. The time between successive measurements can be adjusted on a continuous basis.

3-5 The input signals for all operating modes are conditioned for use by the CHANNEL A and B amplifiers. These amplifiers condition their input signals by providing AC or DC coupling, x1 or x10 attenuation, + or - slope trigger selection, and continuously variable positive or negative threshold voltage adjustments for trigger level control. A series of high gain amplifiers square the leading and trailing edges of the input signal to provide a digital pulse train representative of the input frequency. The pulse train is interfaced to provide the amplifier with output voltage levels which are TTL compatible.

3-6 The Mode Control Logic accepts the outputs of the CHANNEL A and B amplifiers along with the output of a precision Time Base Generator, and depending on the position of the FUNCTION switch, routes them to the Time Base Divider and/or the Display Counter. The Time Base Divider, when used, divides the Reference Frequency by a selectable power of 10 to provide an Output Period equal to 10^0 through 10^5 periods of the Reference Frequency. The selected Output Period controls the time during which the other input frequency is allowed to accumulate or totalize in the Display Counter before being displayed. The Time Base Divider is not used in the A GTD BY B mode. Instead the output of the CHANNEL B amplifier is used to determine the time during which the Display Counter is enabled.

3-7 The Measurement Cycle Logic controls the time between successive measurements, and provides the Display Counter with an Update and Reset command following each measurement cycle. When a measurement is completed, the Display Counter is disabled and an End of Measurement (EOM) command is sent to the Measurement Cycle Logic. The EOM command enables the Cycle Logic causing it to sequentially generate the display Update and Reset pulses. The time between the two pulses is variable depending on the position of the CYCLE RATE control. The display Update pulse enables the display memory to enter the data currently contained in the counter. The new data is immediately transferred to the display LED's. When the cycle rate period is elapsed, the Reset pulse is generated to reset the counter and start a new measurement.

3-8 The Display Counter, when enabled, counts or accumulates each Clock Input pulse received from the Mode Control Logic. The counters are arranged in decade-series fashion and are capable of accumulating nine counts in each of the seven available decades. When the counters are disabled at the end of a measurement, the accumulated data is transferred to a display memory by the action of the Update pulse from the Measurement Logic. The new contents of the updated memory immediately appears on the LED display. As a new measurement is initiated, the Reset pulse resets the counters to zero but does not affect the memory or display. Included on the display are decimal point and measurement units information derived from the FUNCTION and RANGE switch settings.

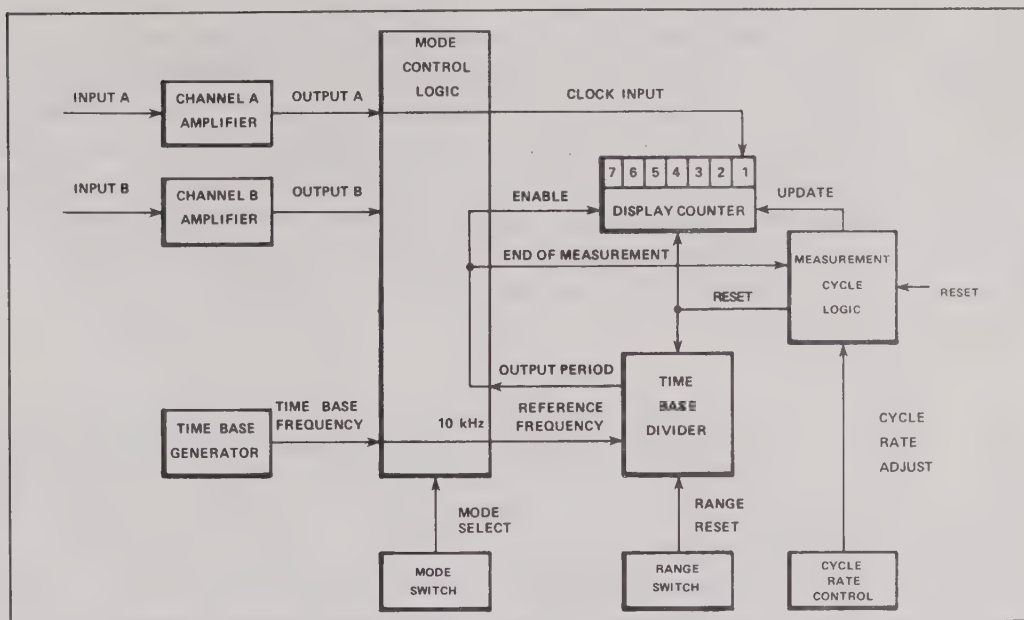


Figure 3-2 . FREQUENCY A FUNCTION, SIMPLIFIED DATA FLOW CHART .

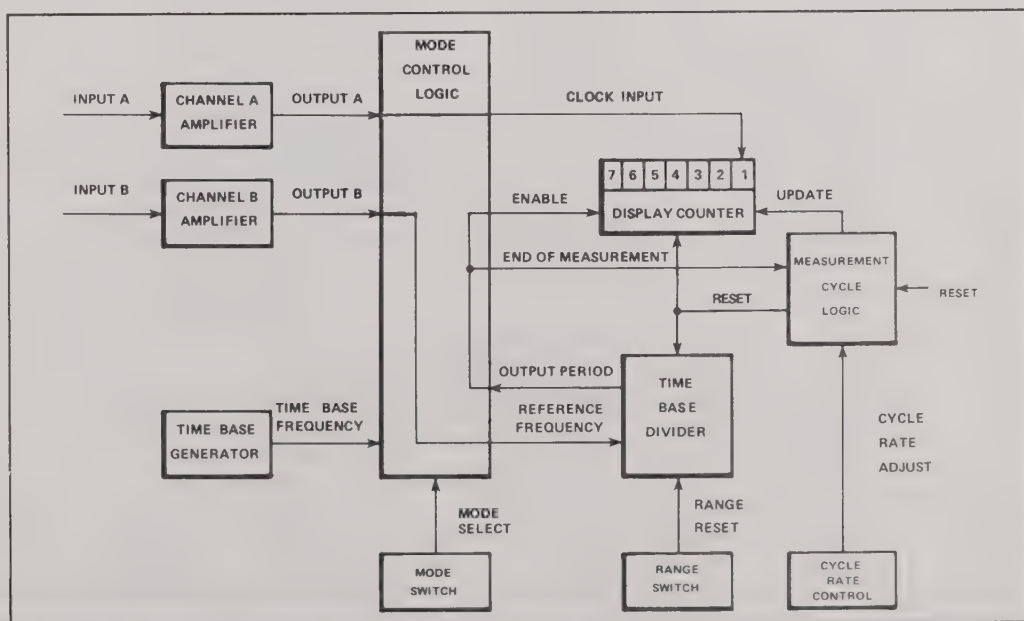


Figure 3-3 . FREQUENCY (A/B)N FUNCTION, SIMPLIFIED DATA FLOW CHART .

3-9 Frequency Mode

3-10 In the frequency mode the counter assumes the configuration shown in Figure 3-2. The input frequency is applied at Input A and routed through the Mode Control Logic to provide the Input Clock for the Display Counter. A 10 kHz Time Base Frequency derived from the Time Base Generator is used as the Reference Frequency for the Time Base Divider. The resulting Output Period generated by the Time Base Divider is selectable by powers of 10 (0.1 ms to 10 s) using the RANGE switch. The precise Output Period is used to enable the Display Counter and allow the Clock Input to accumulate for the specified time. The accumulated count is then displayed as frequency. Frequency resolution is increased as the Output Period of the Time Base Divider is increased.

3-11 Ratio Mode

3-12 In the FREQ (A/B)N mode, ratio measurements are made using the configuration shown in Figure 3-3. The Input A frequency is routed through the Mode Control Logic and used as the Clock Input for the Display Counter. The Input B frequency is routed through the Mode Control Logic and is used as the Reference Frequency to the Time Base Divider. The output of the Time Base Divider can be selected by the RANGE switch to provide an Output Period equal to from 10^0 to 10^5 periods of the Reference Frequency. The selected Output Period enables the Display Counter and as a result, the Input A frequency is accumulated for the duration of the Output Period. At the end of the Output Period the Display Counter is disabled and the EOM signal is generated.

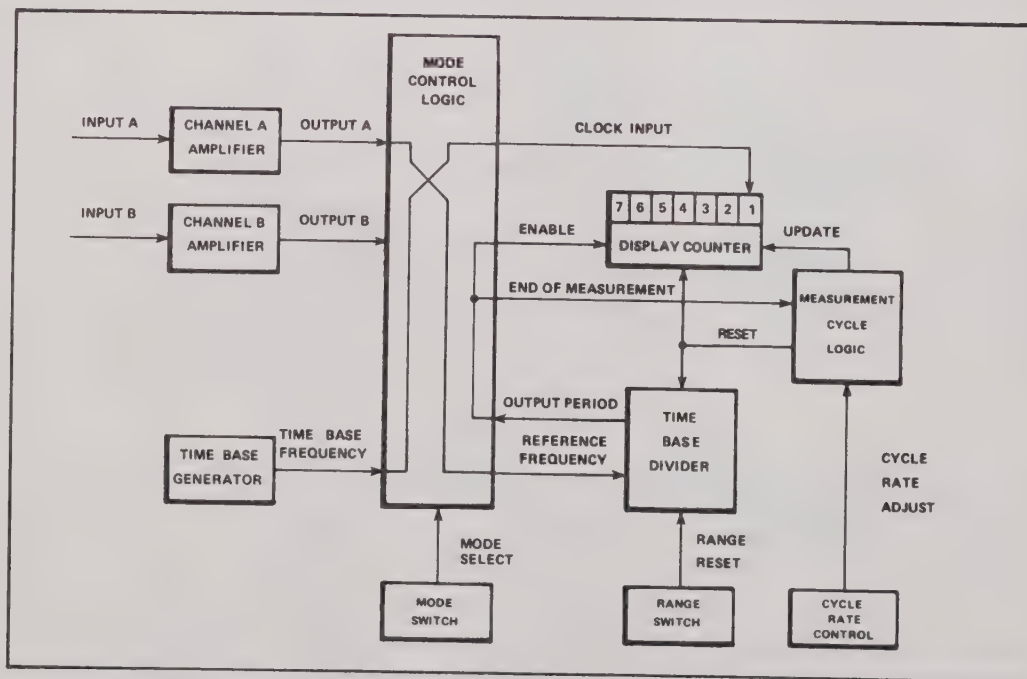


Figure 3-4 . PERIOD A FUNCTION, SIMPLIFIED DATA FLOW CHART .

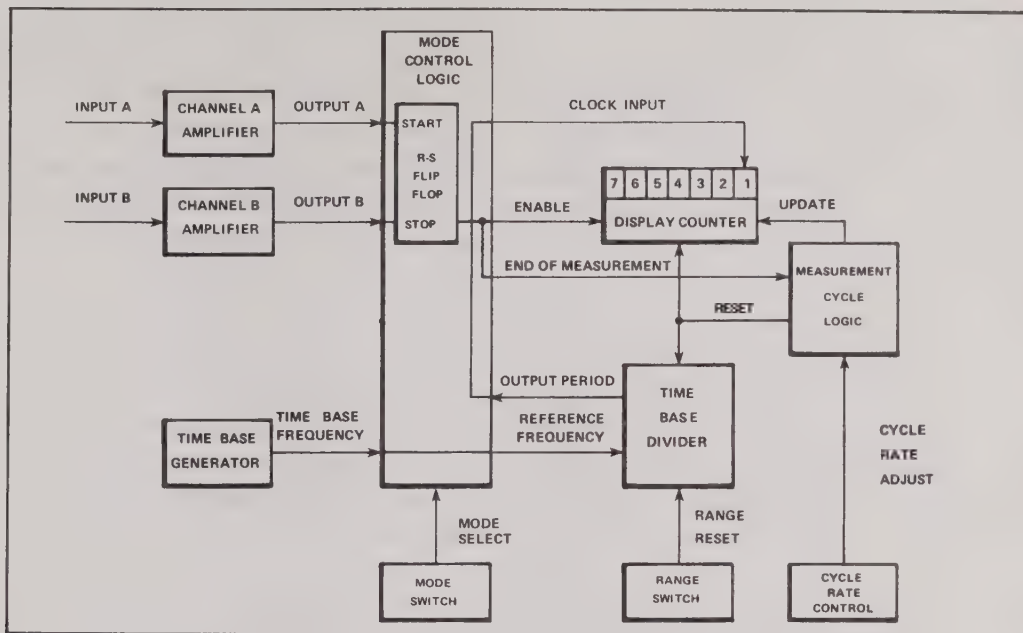


Figure 3-5 . TIME INTERVAL FUNCTION, SIMPLIFIED DATA FLOW CHART .

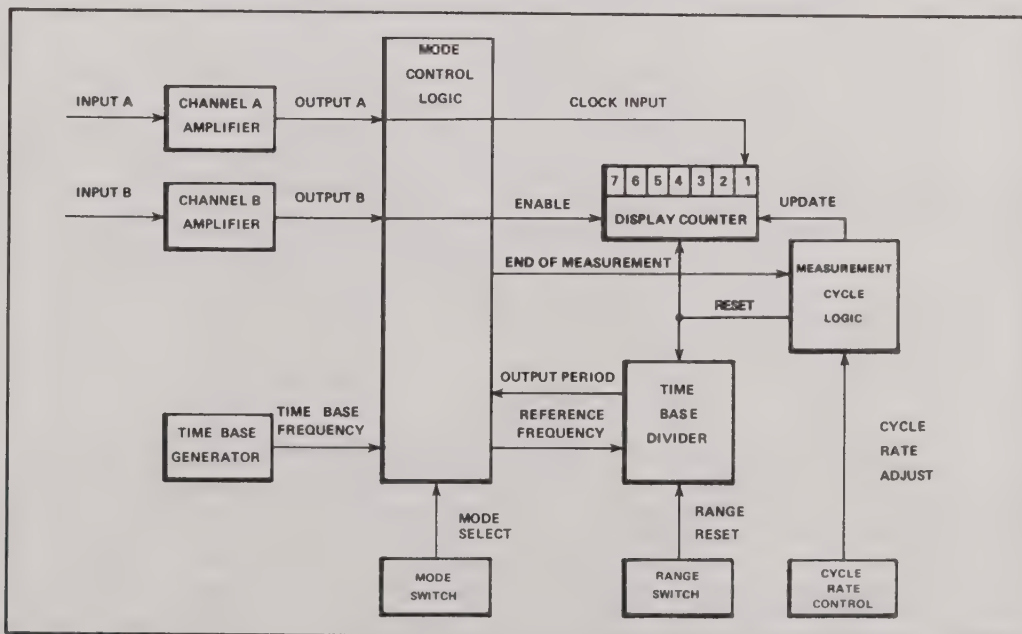


Figure 3-6 . TOTALIZE FUNCTION, SIMPLIFIED DATA FLOW CHART .

3-13 Period Mode

3-14 In the period mode, as shown in Figure 3-4, a 100 kHz signal from the Time Base Generator is routed through the Mode Control Logic and is used as the Clock Input to the Display Counter. This 100 kHz clock is totalized by the counter for multiple periods of the Input A signal. The Time Base Divider receives the Input A signal as the Reference Frequency and provides a timed Output Period equal to 10^0 through 10^5 periods of the Reference Frequency. The duration of the Output Period is selectable using the RANGE switch. At the end of the selected Output Period, the Display Counter is disabled and the EOM signal is generated.

3-15 Time Interval

3-16 In the Time Interval mode, as shown in Figure 3-5, the Display Counter accumulates Clock Input pulses for a time interval started by Input A and stopped by Input B. The Clock Input, as received from the Time Base Divider, is selectable by powers of 10 from 10 MHz to 100 Hz. The Reference Frequency for the Time Base Divider is derived from the 10 MHz output of the Time Base Generator.

3-17 The first input transition detected by the CHANNEL A Amplifier sets an R-S flip-flop in the Mode Control Logic and Enables the Display Counter to start accumulating Clock Input pulses. Some time later, the first input transition detected by the CHANNEL B Amplifier resets the R-S flip-flop and disables the Display Counter. At the same time the End of Measurement signal is generated. The accumulated Clock Input pulses give a direct indication of the time interval between the detection of the A and B input signals.

3-18 Totalize Mode

3-19 In the A GTD BY B mode, as shown in Figure 3-6, an Enable signal derived from Input B allows the Display Counter to totalize the Clock Input pulses derived from Input A. The counter, when repeatedly enabled and disabled using the Input B signal, is not reset. Instead, it sequentially totalizes the Clock Input pulses which occur during each enable period. The Display Counter is reset upon receipt of an external Reset command.

3-20 Self Check Mode

3-21 In the Self Check Function, as shown in Figure 3-7, the logic portion of the 1952B is exercised by the Time Base Generator to verify the overall operation of the counter. The 10 kHz output of the Time Base Generator is processed by the Time Base Divider to provide an Output Period which is selectable in powers of 10 time intervals from 0.1 ms to 10 seconds. The selected time interval (GATE t) is used to Enable the counter and allow a 100 kHz Clock Input, also from the Time Base Generator, to be totalized. When the logic portion of the 1952B is operating properly, the totalized count displayed should be 10, 100, 1000, 10000, 100000 or 1000000 depending on the position of the RANGE switch.

3-22 BLOCK DIAGRAM ANALYSIS

3-23 General

3-24 A block diagram analysis of the functional circuits of the 1952B is given in the following paragraphs. The circuits described correspond to the functional blocks defined in Figure 3-1. Detailed schematics are included at the rear of the manual.

3-25 Power Supply

3-26 The Power Supply consists of a 115/230 V ac transformer, associated switches, fuse, power input connector and regulating circuitry. The function of the power supply is to provide + 5 + 11 and - 11 V dc regulated operating voltages for the 1952B circuitry. The + 5 V dc is used to operate the digital portion of the circuitry while the + 11 and - 11 V dc supplies operate the analog portion of the circuitry. All three operating voltages are generated using conventional isolating and regulating techniques. Refer to the schematic, 1952B - 1001, at the rear of this manual.

3-27 Line power to the power supply is received through the rear panel Input Power Connector, Fuse F1, the front panel CYCLE RATE (power) switch and the 115/230 Voltage select switch. The front panel display illuminates when the regulated + 5 V dc is present.

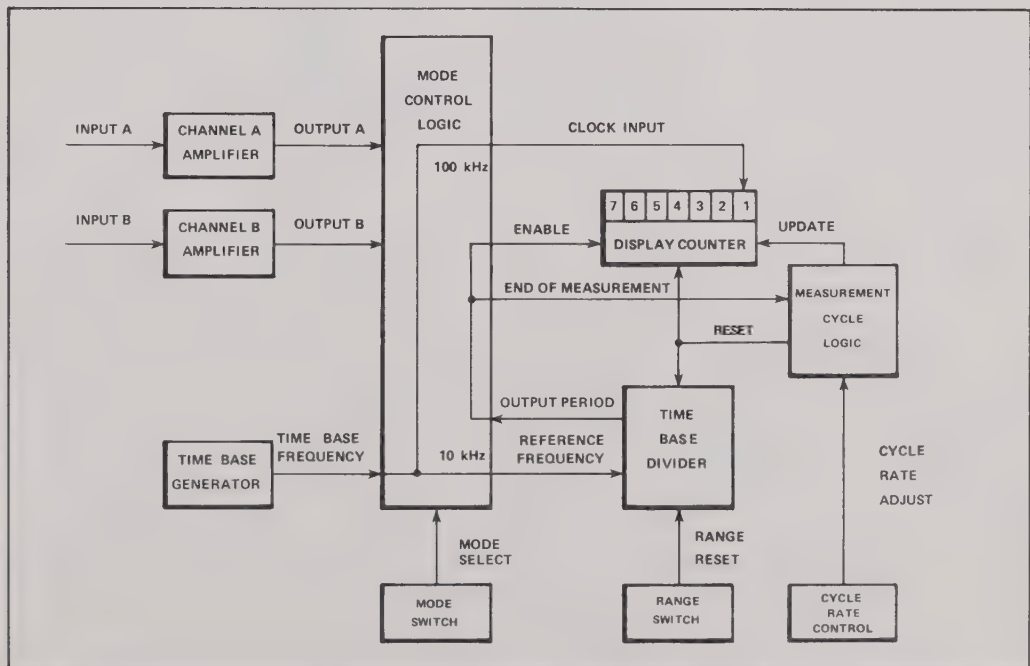


Figure 3-7 . SELF CHECK FUNCTION, SIMPLIFIED DATA FLOW CHART .

3-28

Mode Control Logic

3-29

The mode Control Logic as shown in the schematic at the rear of this manual is controlled by the position of the front panel FUNCTION switch. The truth table given in the schematic defines Inputs to the Mode Control Logic which are required to interconnect the various functional blocks of the 1952B and thus configure each particular operating mode. Each of the possible mode configurations are defined earlier in this section under the overall functional description.

3-30

Channel A and B Amplifiers

3-31

The CHANNEL A and B Amplifiers are electrically similar. Therefore, an analysis of the CHANNEL A amplifier is sufficient to describe both amplifiers.

3-32

The CHANNEL A Amplifier, as shown in Figure 3-8, consists of a high gain differential amplifier, input coupling and attenuator circuits, a Trigger Level Adjust circuit, Slope switch, Status indicators and an inverter. The function of the CHANNEL A Amplifier is to define an acceptable input signal and to produce a TTL compatible, output pulse for each acceptable Input cycle that occurs.

3-33

In operation, front panel slide switches permit the Input signal to be AC or DC coupled and attenuated by a factor of 1 or 10 before being delivered as an input to the high gain

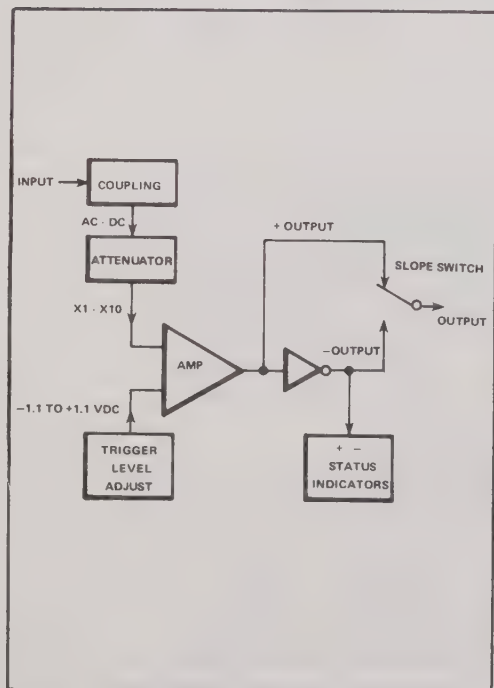


Figure 3-8 . INPUT AMPLIFIER,
FUNCTIONAL BLOCK DIAGRAM .

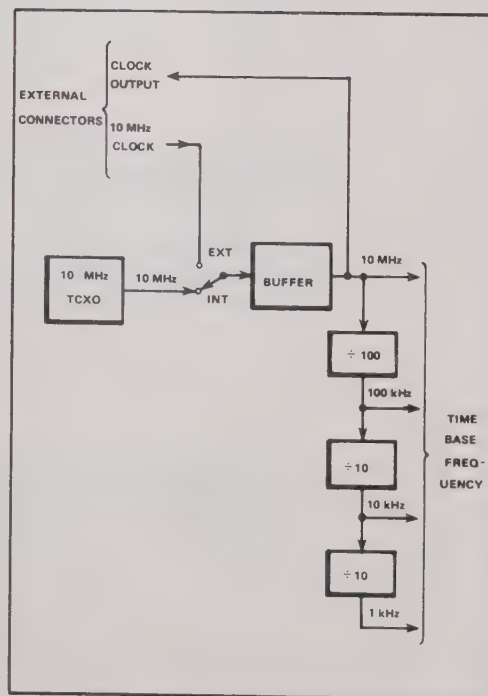


Figure 3-9 . TIME BASE GENERATOR,
SIMPLIFIED BLOCK DIAGRAM .

differential amplifier. The high gain amplifier operates as an open loop voltage comparator. The comparators reference voltage is established by the Trigger Level Adjust whose output is continuously adjustable from + 1.1 to - 1.1 V dc. When the input voltage exceeds the reference voltage, the amplifier generates a leading or lagging edge output transition, depending on the position of the Slope Switch. One of the Status Indicators is normally illuminated to indicate the polarity of the input required to produce an output. The illumination pattern is reversed when an output is generated.

3-34 Time Base Generator

3-35 The Time Base Generator, as shown in Figure 3-9, consists of a 10 MHz Crystal Oscillator, a buffer and four BCD counters. The function of the Time Base Generator is to generate four separate output frequencies (10 MHz, 100 kHz, 10 kHz and 1 kHz) using a standard 10 MHz frequency source to the Buffer input. The Buffer, equipped with input overvoltage protection, converts the 10 MHz input signal to a buffered, TTL compatible output. The 100 kHz, 10 kHz and 1 kHz outputs are derived from the 10 MHz output using decade counters operated in series.

3-36 Time Base Divider

3-37 The Time Base Divider, as shown in Figure 3-10, consists of five BCD counters which are connected in series to provide six separate output frequencies. Each frequency is a power of 10 multiple of the Reference Frequency and can be selected for use as an Output Period signal by properly positioning the RANGE switch.

3-38 Display Counter

3-39 The Display Counter, as shown in Figure 3-11, consists of four flip-flops, one LED

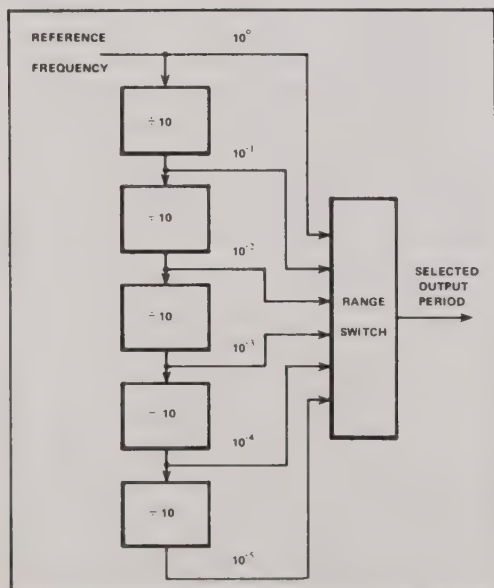


Figure 3-10 . TIME BASE DIVIDER,
SIMPLIFIED BLOCK DIAGRAM .

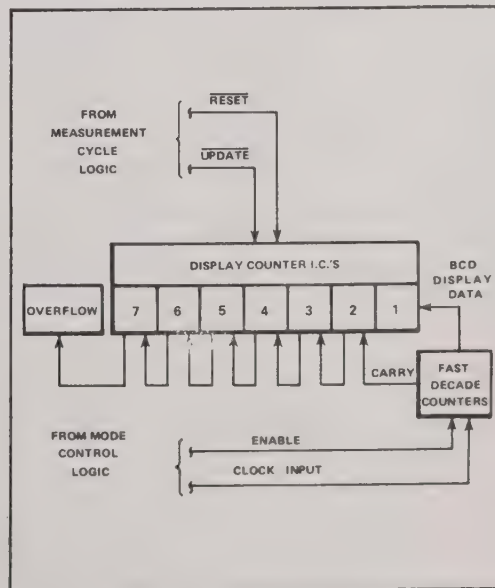


Figure 3-11 . DISPLAY COUNTER,
SIMPLIFIED BLOCK DIAGRAM .

and seven Display-Counter (Numeric Display with Logic) IC's. The function of the Display Counter is to totalize, store and display each Clock Input pulse which occurs while the Enable signal is at a logic 1. In operation, seven Display Counter IC's are cascaded to form a seven decade counter. Since the least significant counter decade must be capable of operating at an 80 MHz rate, the counter section of that decade is replaced with a Fast Decade Counter which consists of four separate flip-flops. The Carry output of the Fast Decade Counter is used as a clock input for the second least significant decade while the BCD output of the Fast Decade Counter is used as display data for the least significant decade.

3-40 When the Enable input is at a logic 1, the Clock Input signal is totalized but the accumulated total is not displayed until an Update command (logic 0) is received. The Update command enables a latch in each Display Counter IC to store the output of the associated counter. The data in the latch is displayed as a numeric digit and will continue to be displayed after the Update command is removed. The counters are cleared to zero using the Reset command. Sequentially commanding the Reset and Update commands causes both the counter and display to be set to zero.

3-41 Measurement Cycle Logic

3-42 The Measurement Cycle Logic, as shown in Figure 3-12, consists of a flip-flop, one BCD counter, a one of 10 decoder and an adjustable one-shot. The function of the Measurement Cycle Logic is to interlock and control the actions of both the measurement cycle and the subsequent transfer of accumulated measurement data to the Display Counter readouts. In operation, the BCD counter is initially setting at a count of four indicating that a measurement cycle has been completed and that a Reset command is required to initiate a new measurement. The Reset command can be generated using the manual RESET switch. The manual Reset command resets the counter to zero while the cycle rate one-shot (when timed out) enables the counter to sequence through to the count of nine. The nine count is feedback to the flip-flop and the count sequence is again inhibited. In either event, the reset action initiates a new measurement cycle and causes the BCD counter to be reset to zero by the EOM command. The EOM command remains low for the duration of the measurement cycle and returns to the high state to indicate that the cycle is complete. When the Measurement Cycle is complete, the counter is enabled and advanced by the 500 Hz clock generated by the flip-flop. As count number one is decoded, the Update pulse is generated to transfer accumulated data to the display readout. Count number two is used to trigger the one-shot if the INT - EXT switch is in the INT position. Count number four returns the Measurement Cycle Logic to the initial position. Notice that when the one-shot is used to restart the counter, count number seven is used to generate the Reset pulse.

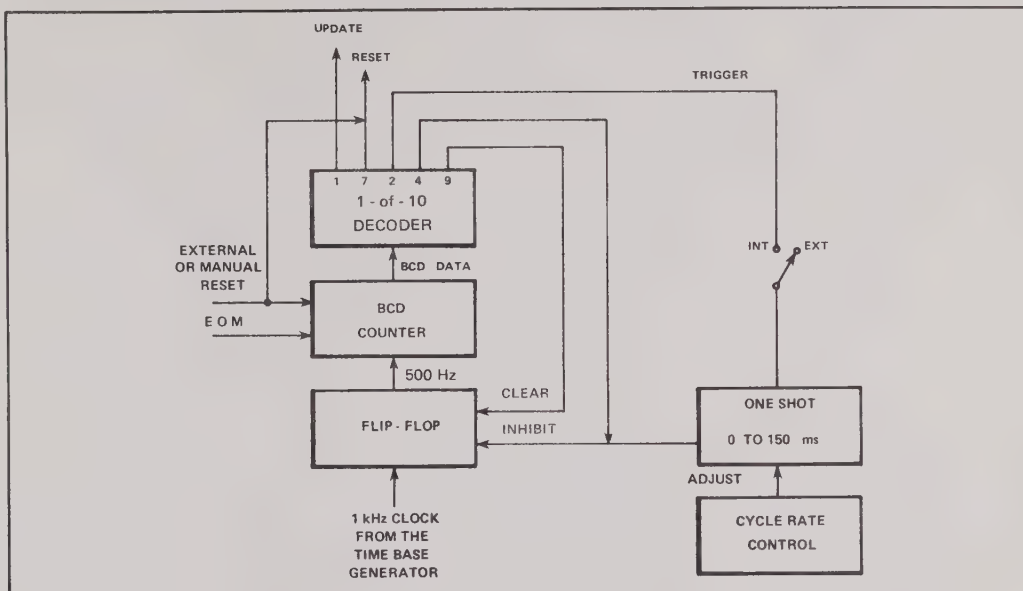


Figure 3-12 . MEASUREMENT CYCLE LOGIC,
SIMPLIFIED BLOCK DIAGRAM .

Section 4

Maintenance

4-1 INTRODUCTION

4-2 This section of the manual contains maintenance information for the Model 1952B. This includes service information, general maintenance, performance test, calibration and troubleshooting. The performance test is recommended as a preventative maintenance tool and should be executed every 90 days to verify proper instrument operation. Troubleshooting information is given in the form of flowcharts at the end of this section. Table 4-1 lists the recommended test equipment required for the performance test and troubleshooting.

Table 4-1 EQUIPMENT REQUIRED FOR
PERFORMANCE TEST AND TROUBLESHOOTING

EQUIPMENT TYPE	REQUIRED BASIC SPECIFICATIONS	WHERE USED
Quartz oscillator frequency standard with 10 or 1 & 5 or 50 MHz output	Short term stability to be better than 1×10^{-8} Long term stability to be better than 1×10^{-9} @ 0 - 50°C ambient temperatures	Time Base Oscillator Adjustment
Low Frequency Oscillator	Frequency Range: DC - 10 MHz; Variably attenuated output from 1 mV rms to 1 V or 5 V rms @ 50 ohms output impedance; selectable sinewave and square wave modes;	Performance Check; Calibration
High Frequency Oscillator	Frequency Range: 10 MHz - 100 MHz Variably attenuated calibrated output from 1 mV to 1 V or 5 V rms (50 ohms output impedance); CW mode	Performance Check; Calibration

EQUIPMENT TYPE	REQUIRED BASIC SPECIFICATIONS	WHERE USED
RF Millivoltmeter	Frequency Range: 10 kHz - 100 MHz; Voltage Range: 1 mV - 5 V rms Accuracy: Maximum 3% of reading @ 100 MHz + 1% full scale VSWR: Less than 1:1.15 Power Sensitivity: 200 pW @ 50 ohms Basic Accessories: 50 ohms BNC Adapter;	Performance Check; Calibration
Multimeter	Capable of measuring DC & AC voltage: DC & AC current; Resistance DC VOLTAGE RANGE of ± 199.9 mV to ± 1999 V with accuracy better than $\pm 1\%$ of reading AC VOLTAGE RANGE of 199.9 mV to 1999 V with accuracy better than $\pm 1.5\%$ of reading DIRECT CURRENT RANGE of ± 199.9 μ A to ± 1999 mA with accuracy better than $\pm 1\%$ of reading ALTERNATING CURRENT RANGE of 199.9 μ A to 1999 mA with accuracy better than $\pm 1.5\%$ of reading RESISTANCE RANGE of 199.9 ohms to 19.99 M ohm with accuracy better than $\pm 1\%$ of reading	Troubleshooting
Oscilloscope	DUAL TRACE; 100 MHz BANDWIDTH 2 mV per division sensitivity; TIME BASE @ 0.05 μ s/div. with time delay features	Troubleshooting

4-3 SERVICE INFORMATION

4-4 Each instrument that is manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is given on the back of the title page located in the front of this manual.

4-5 Factory authorized calibration and service for each Fluke product is available at various world wide locations. A complete list of these service centers is included with the WARRANTY. Shipping information is given in the operating instructions section of this manual. If requested, an estimate will be provided to the customer before work is begun on instruments that are beyond the warranty period.

4-6 GENERAL MAINTENANCE

4-7 Access Information

4-8 All PCB assemblies used in the Model 1952B can be accessed for maintenance purposes by removing the top and bottom dust covers from the instrument. Four phillips head screws hold each dust cover in place. Once the top dust cover is removed, the Display-Counter PCB and Switch assemblies can be removed using the procedures outlined in the following paragraphs.

4-9 DISPLAY COUNTER PCB ASSEMBLY

4-10 Use the following procedure to remove the Display Counter PCB Assembly from the 1952B.

- a. Remove the top and bottom dust covers.
- b. Remove the knobs from all front panel controls.
- c. Remove the front panel nuts from the FUNCTION, RANGE and RESET switches.
- d. Remove the two screws located on both side brackets close to the front panel.
- e. Turn the instrument over and unsolder the connections to the CHANNEL A and B, BNC connectors.
- f. Unsolder the two wires at the rear of the CYCLE RATE control.
- g. Using a rocking motion pull the front panel free of the chassis.
- h. Locate and remove the four screws holding the Display Counter PCB Assembly to the front panel.
- i. Install the Display Counter PCB Assembly by logically reversing this procedure.

4-11 SWITCH PCB ASSEMBLY

4-12 Use the following procedure to remove the Switch PCB Assembly from the 1952B.

- a. Complete steps a. through h. of the procedure given for removing the Display Counter PCB Assembly.

- b. Pull the Switch PCB Assembly out of the card edge connector.
- c. Install the Switch PCB Assembly by logically reversing this procedure.

4-13 Cleaning

4-14 Clean the Model 1952B periodically to remove dust, grease and other contamination. Use the following procedure:

- a. Clean the surface of all PCB's using clean dry air at low pressure (<120 PSI). If grease is encountered, spray with Freon T.F. Degreaser and remove grime with clean dry air at low pressure.
- b. Clean the front panel with a soft cloth dampened with a mild solution of detergent and water.

4-15 Fuse Replacement

4-16 The power fuse F1 is located on the rear panel of the Model 1952B. If replacement is necessary, use the following rated fuses:

- a. 1 Amp slo-blo for 115 V ac
- b. 1/2 Amp slo-blo for 230 V ac

4-17 Service Tools

4-18 No special tools are required to maintain or repair the Model 1952B Counter/Timer.

4-19 PERFORMANCE TEST

The performance test is designed to verify the overall operation of the Model 1952B. This test can be used as an acceptance check and/or periodic maintenance check. Table 4-1 lists the equipment required to perform this test. If the counter fails any part of the performance test, corrective action is indicated. Troubleshooting information for fault isolation is given later in this section.

4-20 Set-Up Procedure

4-21 Prior to executing the performance test complete the following set-up procedure:

- a. Connect the Model 1952B to line power.
- b. Rotate the CYCLE RATE control out of the POWER OFF detent and set to the maximum CW position. The front panel display should illuminate.
- c. Set the rear panel EXT-INT switch to the INT position.
- d. Set the CONT-TRIG switch to the CONT position.

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- b. Remove the knobs from all front panel controls.
- c. Remove the front panel nuts from the FUNCTION, RANGE and RESET switches.
- d. Remove the two screws located on both side brackets close to the front panel.
- e. Turn the instrument over and unsolder the connections to the CHANNEL A and B, BNC connectors.
- f. Unsolder the two wires at the rear of the CYCLE RATE control.
- g. Using a rocking motion pull the front panel free of the chassis.
- h. Locate and remove the four screws holding the Display Counter PCB Assembly to the front panel.
- i. Install the Display Counter PCB Assembly by logically reversing this procedure.

4-11 SWITCH PCB ASSEMBLY

4-12 Use the following procedure to remove the Switch PCB Assembly from the 1952B.

- a. Complete steps a. through h. of the procedure given for removing the Display Counter PCB Assembly.

- b. Pull the Switch PCB Assembly out of the card edge connector.
- c. Install the Switch PCB Assembly by logically reversing this procedure.

4-13 Cleaning

4-14 Clean the Model 1952B periodically to remove dust, grease and other contamination. Use the following procedure:

- a. Clean the surface of all PCB's using clean dry air at low pressure (<120 PSI). If grease is encountered, spray with Freon T.F. Degreaser and remove grime with clean dry air at low pressure.
- b. Clean the front panel with a soft cloth dampened with a mild solution of detergent and water.

4-15 Fuse Replacement

4-16 The power fuse F1 is located on the rear panel of the Model 1952B. If replacement is necessary, use the following rated fuses:

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4-19 PERFORMANCE TEST

The performance test is designed to verify the overall operation of the Model 1952B. This test can be used as an acceptance check and/or periodic maintenance check. Table 4-1 lists the equipment required to perform this test. If the counter fails any part of the performance test, corrective action is indicated. Troubleshooting information for fault isolation is given later in this section.

4-20 Set-Up Procedure

4-21 Prior to executing the performance test complete the following set-up procedure:

- a. Connect the Model 1952B to line power.
- b. Rotate the CYCLE RATE control out of the POWER OFF detent and set to the maximum CW position. The front panel display should illuminate.
- c. Set the rear panel EXT-INT switch to the INT position.
- d. Set the CONT-TRIG switch to the CONT position.

e. Set the CHANNEL A and B Trigger Level Controls to the following positions:

1. Trigger Level Adjust to maximum counter clockwise, PRESET.
2. Slope switch to + (positive).
3. Coupling switch to AC.
4. Attenuator switch to X1.

4-22 Channel A Amplifier Test

4-23 Use the following procedure to test the CHANNEL A Amplifier and Trigger Level Controls:

- a. Complete the Set-Up Procedure.
- b. Connect a 2 V rms, 1 kHz signal source to CHANNEL A input connector.
- c. Observe the CHANNEL A Status Indicators. Both should be illuminated.
- d. Change the settings of the Slope, Coupling and Attenuator switches associated with CHANNEL A. The Status Indicators should both remain on.
- e. Set the Attenuator switch to the X10 position and the Coupling switch to the AC position.
- f. Move the Trigger Level Adjust just out of the Preset detent. The + Status Indicator should be on and the - indicator should be off.
- g. Move the Trigger Level Adjust CW to the center of its travel. Both Status Indicators should be lit.
- h. Move the Trigger Level Adjust to the maximum CW position. The - Status Indicator should be on the + indicator should be off.

4-24 Channel B Amplifier Test

4-25 Test the CHANNEL B amplifier using the general procedure given in the previous paragraph for testing the CHANNEL A amplifier. Substitute CHANNEL B in all cases where CHANNEL A is mentioned.

4-26 Display Test

4-27 Test the front panel display using the following procedure:

- a. Complete the Set-Up Procedure.
- b. Refer to Table 4-2 and sequentially select each of the RANGE switch settings for each setting of the FUNCTION switch. As each range is selected ensure that the numeric readout, decimal point location and measurement units are correctly displayed.

- c. Set the FUNCTION switch to the A GTD.BY B position.
- d. Connect a 1 V rms, 5 Hz signal source to the CHANNEL A Input Connector.
- e. Set the CHANNEL A Coupling switch to DC.
- f. Rotate the CHANNEL B Trigger Level Adjust CW out of the preset position until the display begins to accumulate the CHANNEL A input frequency. As each count is received, observe the least significant decade and ensure that each number is properly displayed.
- g. Slowly increase the input frequency as necessary to check the operation of each decade. When all display decades reach a count of nine, the next input signal will overflow the counter and cause the display to read all zeros. In addition, an OVERFLOW LED is illuminated to indicate that the counter capability has been exceeded.
- h. Press the RESET button. The display should reset to zero and the OVERFLOW indicator should be turned off. When the button is released the totalizing process starts over.

TABLE 4-2. RANGE DISPLAY INFORMATION FOR AVAILABLE FUNCTIONS

MODE	RANGE INDICATIONS	DISPLAY FOR AVAILABLE RANGE SETTINGS					
FREQ. A	GATE t DISPLAY MEAS. UNITS	0.1 ms .00 MHz	1.0 ms .000 MHz	10 ms .0000 MHz	0.1 s .00 kHz	1.0 s .000 kHz	10 s .0000 kHz
FREQ. (A/B)N	PER. AVGD. DISPLAY MEAS. UNITS	10 ⁰ 0 NONE	10 ¹ 0 NONE	10 ² 0 NONE	10 ³ 0 NONE	10 ⁴ 0 NONE	10 ⁵ 0 NONE
PERIOD A	PER. AVGD. DISPLAY MEAS. UNITS	10 ⁰ .00 ms	10 ¹ .000 ms	10 ² .0000 ms	10 ³ .00 us	10 ⁴ .000 us	10 ⁵ .0000 us
T.I. A-B	T.I. RES DISPLAY MEAS. UNITS	.1 us .0000 ms	1 us .000 ms	10 us .00 ms	0.1 ms .0000 s	1.0 ms .000 s	10 ms .00 s
A GTD.BY B	RANGE DISPLAY MEAS. UNITS	N/A NONE NONE	N/A NONE NONE	N/A NONE NONE	N/A NONE NONE	N/A NONE NONE	N/A NONE NONE
SELF CHECK	GATE t DISPLAY MEAS. UNITS	0.1 ms 10 NONE	1.0 ms 100 NONE	10 ms 1000 NONE	0.1 s 10000 NONE	1.0 s 100 000 NONE	10 s 1000 000 NONE

4-28 Frequency A Test

4-29 Test the Frequency A mode using the following procedure:

- a. Complete the Set-Up Procedure.
- b. Set the FUNCTION switch to the FREQ A position.
- c. Connect a 1 V rms, 100 kHz signal source to the CHANNEL A Input Connector.

- d. Set the RANGE switch to each of the GATE t positions listed in Table 4-3 and ensure the numeric and measurement units display are reading correctly.

Table 4-3. DISPLAY READOUT FOR
FREQUENCY A TEST.

GATE t SETTING	NUMERIC READOUT*	MEASUREMENT UNITS
0.1 ms	.10	MHz
1.0 ms	.100	MHz
10 ms	.1000	MHz
0.1 s	100.00	kHz
1.0 s	100.000	kHz
10 s	100.0000	kHz

* The accuracy of the numeric readout is dependent on the frequency accuracy of the 100 kHz signal source.

4-30 Ratio Test

4-31 Test the Frequency (A/B)N ratio mode using the following procedure:

- Complete the Set-Up Procedure.
- Set the FUNCTION switch to the FREQ (A/B)N position.
- Set the SEP - COM switch to the COM position.
- Connect a 1 V rms, 100 kHz signal source to the CHANNEL A Input Connector.
- Set the RANGE switch to each of the PER.AVGD (period averaged) positions listed in Table 4-4 and ensure that the display readout is correct for each position. Decimal point and measurement units information are not displayed in the ratio mode.

Table 4-4. DISPLAY READOUT FOR RATIO
FUNCTION TEST.

PER AVGD. SETTING**	NUMERIC READOUT
10^0	1
10^1	10
10^2	100
10^3	1000
10^4	10000
10^5	100000

** A ratio of 1 is indicated in all cases. The decimal point is determined by starting at the right of the readout

counting to the left the number of places indicated by the exponent for the PER.AVG.D. setting.

4-32 Period A Test

4-33 Check the period A mode using the following procedure:

- a. Complete the Set-Up Procedure.
- b. Set the FUNCTION switch to the FREQ A position.
- c. Connect a 1 V rms, 10 kHz signal source to the CHANNEL A Input Connector.
- d. Set the RANGE switch to the 10 s position and adjust the signal source to produce a display of 10.0000 kHz on the 1952B.
- e. Set the FUNCTION switch to the PERIOD A position.
- f. Set the RANGE switch to each of the PER.AVG.D. positions listed in Table 4-5 and ensure that the display readout is correct for each position.

Table 4-5. DISPLAY READOUTS FOR PERIOD A TEST

PER.AVG.D. SETTINGS	NUMERIC READOUT*	MEASUREMENT UNITS
10^0	.10	ms
10^1	.100	ms
10^2	.1000	ms
10^3	100.00	us
10^4	100.000	us
10^5	100.0000	us

* The accuracy of the readout is dependent on the frequency accuracy of the 10 kHz signal source.

4-34 Time Interval Test

4-35 Test the time interval mode using the following procedure:

- a. Complete the Set-Up Procedure.
- b. Set the FUNCTION switch to the FREQ A position.
- c. Connect a 1 V rms, 100 Hz signal source to the CHANNEL A Input Connector.
- d. Set the RANGE switch to the 10 s position and adjust the signal source to produce a display of 0.1000 kHz on the 1952B.
- e. Set the FUNCTION switch to the T.I. A-B position.
- f. Set the SEP - COM switch to the COM position.

- g. Set the RANGE switch to each of the T.I. RES. (time interval resolution) positions listed in Table 4-6 and ensure that the display readout is correct for each position.

Table 4-6. DISPLAY READOUTS FOR TIME
INTERVAL TEST

T.I. RES SETTING	NUMERIC READOUT*	MEASUREMENT UNITS
0.1 us	10.0000	ms
1.0 us	10.000	ms
10 us	10.00	ms
0.1 ms	.0100	s
1.0 ms	.010	s
10 ms	.01	s

* The accuracy of the readout is dependent on the frequency accuracy of the 100 Hz signal source.

4-36 Totalize Test

4-37 Test the totalize mode (A gated by B) using the following procedure:

- a. Complete the Set-Up Procedure.
- b. Set the FUNCTION switch to the A GTD BY B position.
- c. Connect a 1 V rms, 100 Hz signal source to the CHANNEL A Input Connector.
- d. Rotate the CHANNEL B Trigger Level Adjust out of the detent position until the -(minus) Status Indicator is illuminated.
- e. Press the RESET button. The display should return to 0 (zero). Decimal point and measurement units are not displayed.
- f. Rotate the CHANNEL B Trigger Level Adjust until the + (plus) Status Indicator is illuminated. The counter should begin to accumulate and display the 100 Hz input frequency present on the CHANNEL A Input Connector.
- g. Rotate the CHANNEL B Trigger Level Adjust until the - Status Indicator is illuminated. The counter should stop and display the accumulated total.
- h. Repeat steps f. and g. above. The accumulation process should continue as long as the + Status Indicator is illuminated. Notices that as steps f. and g. are repeated the displayed total is not reset. Instead, new inputs are added to the previous total.

4-38 Self Check Test

4-39 Test the self check mode using the following Procedure:

- a. Complete the Set-Up Procedure.
- b. Set the FUNCTION switch to the SELF CHECK position.
- c. Set the RANGE switch to each of the GATE t positions listed in Table 4-7 and ensure that the display readout is correct for each position. Decimal point and measurement units are not displayed.

Table 4-7. DISPLAY READOUT FOR SELF CHECK TEST

GATE t SETTINGS	NUMERIC READOUT
0.1 ms	10
1.0 ms	100
10 ms	1000
0.1 s	10000
1.0 s	100000
10 s	1000000

4-40 CALIBRATION

4-41 The Model 1952B should be calibrated every 90 days or whenever repairs have been made. Calibration should be done at an ambient room temperature of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$. Table 4-1 lists the required equipment.

4-42 Trigger Level Preset Adjust

4-43 Use the following procedure to calibrate the CHANNEL A and B preset trigger levels:

- a. Remove the top dust cover from the Model 1952B.
- b. Connect the 1952B to line power.
- c. Turn-on the 1952B using the CYCLE RATE switch.
- d. Set the CHANNEL A and B Attenuator switches to the X10 position.
- e. Turn the CHANNEL A and B Trigger Level Controls to the maximum counter-clockwise position (PRESET).
- f. Locate the potentiometer directly behind the CHANNEL A Trigger Level Adjust on the main PCB Assembly.
- g. Using a suitable screw driver, rotate the potentiometer until the CHANNEL A -(negative) Status indicator is illuminated. Reverse direction, and slowly turn the pot until the + (positive) Status Indicator just turns-on.
- h. Click the CHANNEL A Trigger Level Adjust in and out of the PRESET detent. The + Status indicator should always illuminate in the preset detent.

- i. Locate the potentiometer directly behind the CHANNEL B Trigger Level Adjust on the main PCB Assembly.
- j. Calibrate the CHANNEL B preset trigger level using the procedures given in steps g. and h. above. Substitute CHANNEL B where CHANNEL A is mentioned.

4-44 Timebase Adjust

4-45 Calibrate the 10 MHz timebase oscillator using the following procedure:

- a. Remove the top dust cover from the Model 1952B.
- b. Connect the 1952B to line power.
- c. Turn-on the 1952B using the POWER/CYCLE RATE switch.
- d. Set the FUNCTION switch to the FREQ A position.
- e. Set the CONT - TRIG switch to the CONT position.
- f. Connect the 1 MHz frequency standard to the CHANNEL A Input Connector.
- g. Adjust the CHANNEL A trigger level controls to establish the desired trigger condition. Proper triggering occurs when the + and - Status Indicators are both illuminated.
- h. Set the RANGE switch to the 10 s GATE t position.
- i. Press and release the RESET switch. After ten seconds the 1952B should display a count of 000.0000 Hz and the OVERFLOW LED should be illuminated.
- j. If the display is incorrect, locate the TIMEBASE adjustment at the BOTTOM rear of the Main Board PCB Assembly, and using an insulated tuning tool, adjust the oscillator tuning screw.
- k. Repeat steps i. and j. of this procedure until the proper display is obtained.

4-46 TROUBLESHOOTING

4-47 The following information is designed to aid in troubleshooting the Model 1952B. Fault isolation is achieved by executing the performance test and isolating the problem to a functional logic group using troubleshooting flowcharts. The flowchart symbols are defined in Figure 4-1 and the troubleshooting flowcharts are given in Figure 4-2.

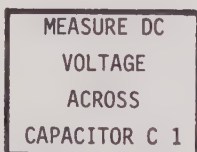
Figure 4-1. TROUBLESHOOTING FLOWCHART SYMBOLS



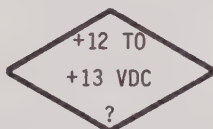
INTERCONNECTS FLOWCHART SYMBOLS AND
INDICATES THE DIRECTION OF PROCEDURE FLOW.



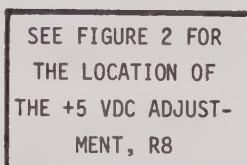
A TERMINAL POINT - USED TO INDICATE A
START, STOP OR INTERRUPT OF PROCEDURE
FLOW.



INSTRUCTION OR PROCEDURAL STEP.



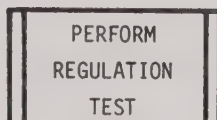
DECISION REQUIRED - ALWAYS ASK A QUESTION -
THE FLOW FROM THE SYMBOL IS DEPENDENT UPON
THE DECISION MADE - USUALLY YES (GO) OR NO
(NO GO), BUT MAY HAVE THREE POSSIBILITIES (eg.
HIGH, LOW, NORMAL).



ANNOTATION - PROVIDES ADDITIONAL INFORMATION
FOR THE SYMBOL TO WHICH IT IS CONNECTED. ALWAYS
CONNECTED BY A DASHED LINE.



CONNECTOR - EXIT TO, OR ENTRY FROM, ANOTHER PART
OF THE FLOWCHART (ASSOCIATED ARROWHEAD SHOWS
WHICH).



PREDEFINED PROCESS - INDICATES THAT THE PROCEDURE
TO BE PERFORMED IS DESCRIBED ELSEWHERE.

Figure 4-2. TROUBLESHOOTING FLOWCHART (Sheet 1 of 6)

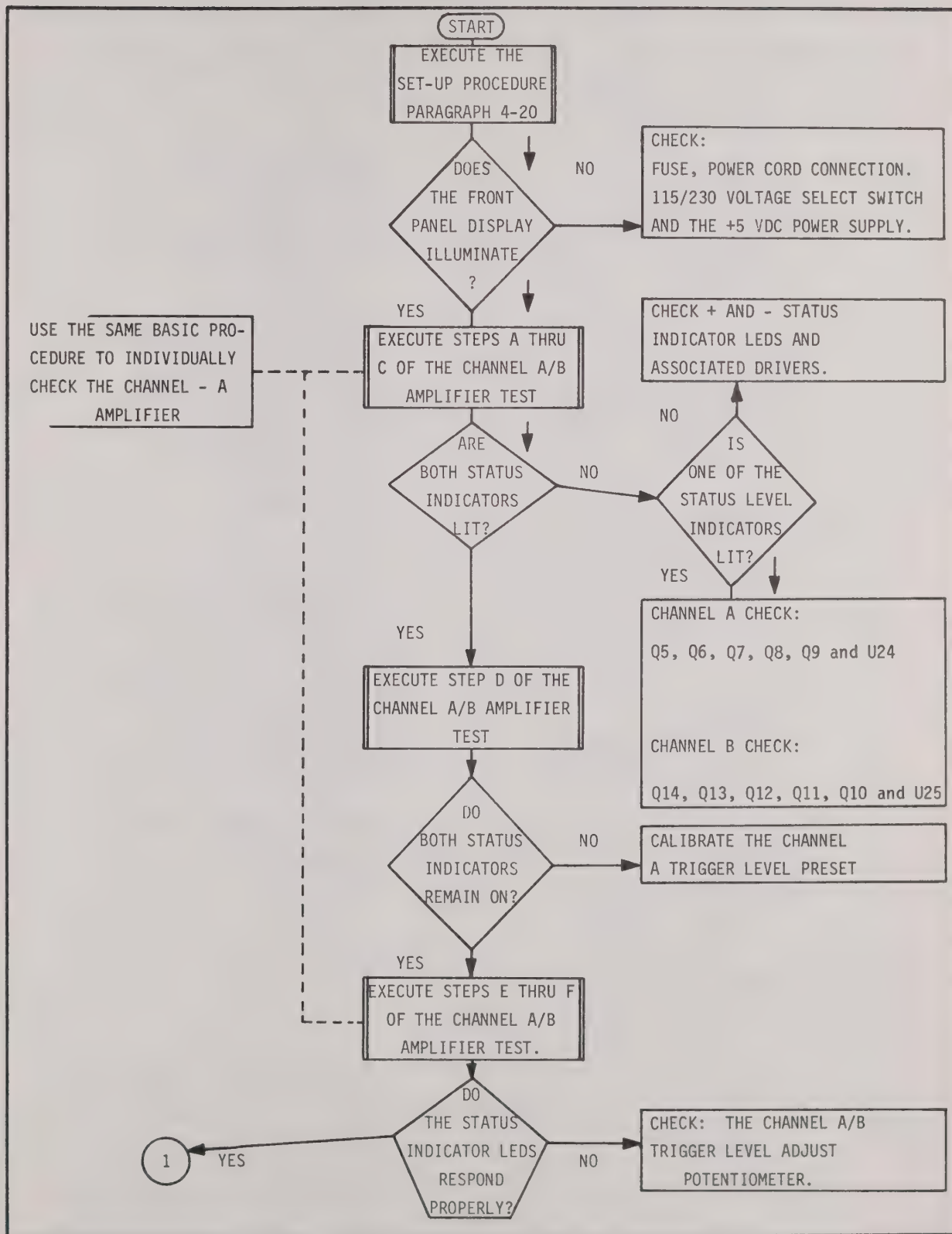


Figure 4-2. TROUBLESHOOTING FLOWCHART (Sheet 2 of 6)

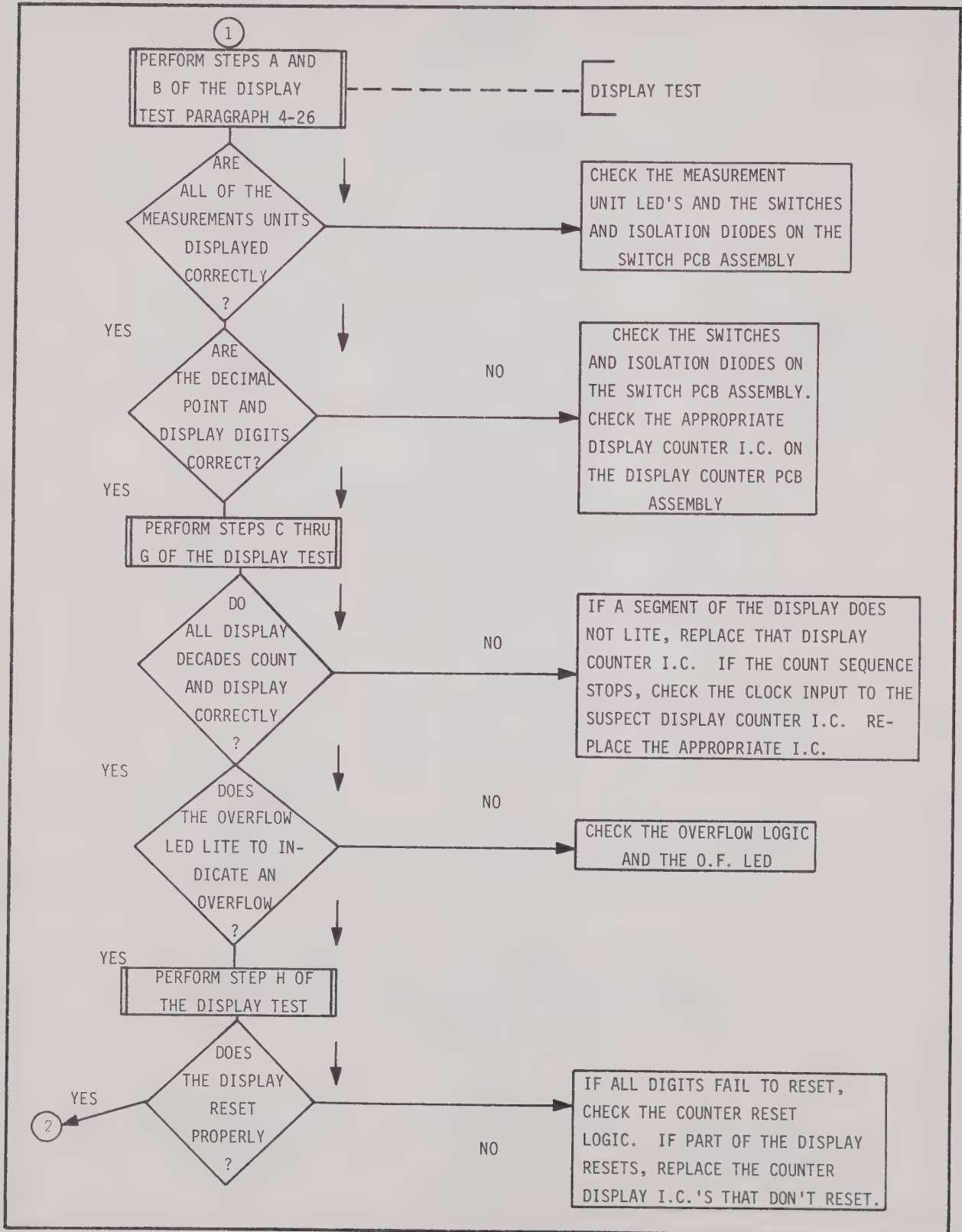


Figure 4-2. TROUBLESHOOTING FLOWCHART (Sheet 3 of 6)

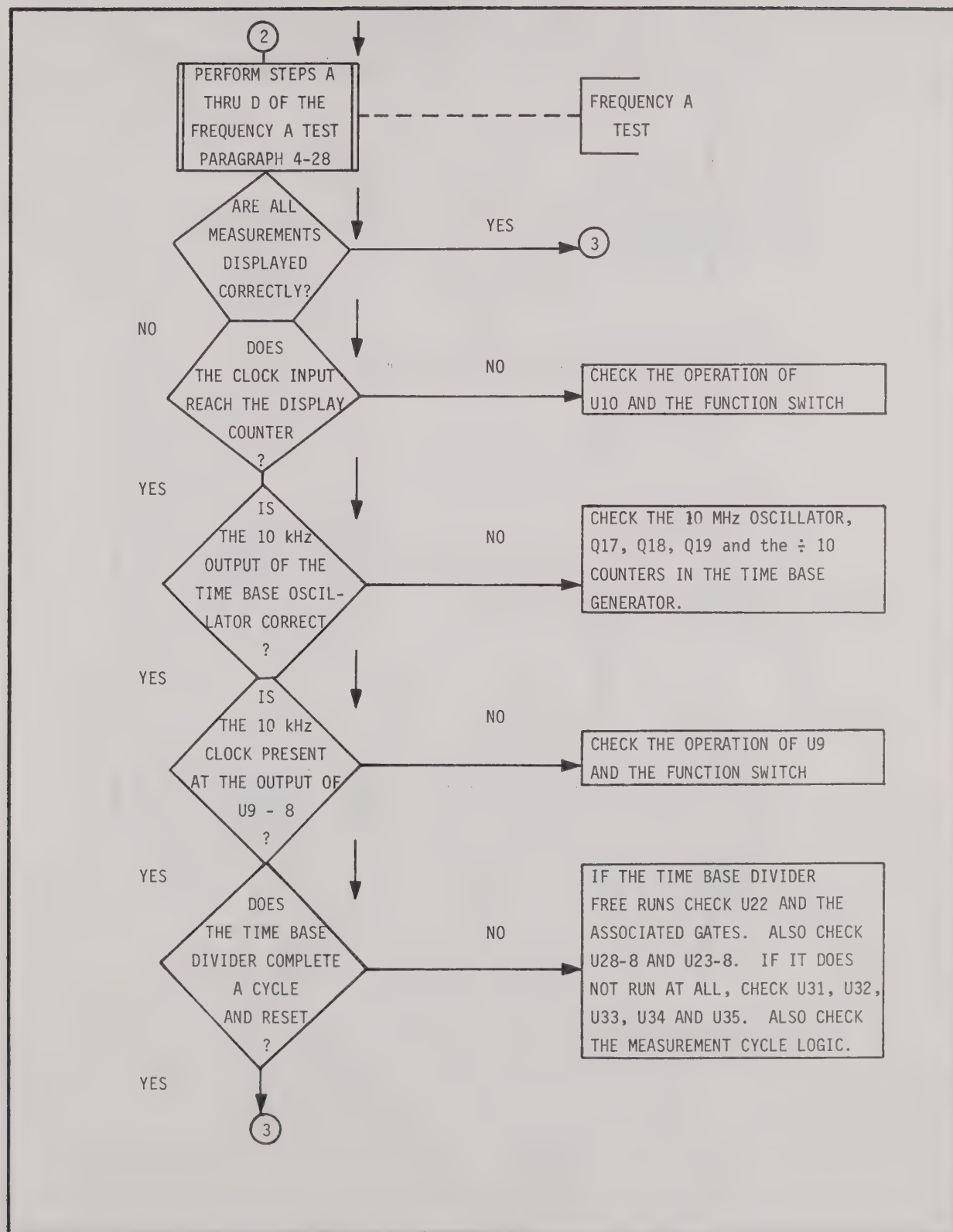


Figure 4-2. TROUBLESHOOTING FLOWCHARTS (Sheet 4 of 6)

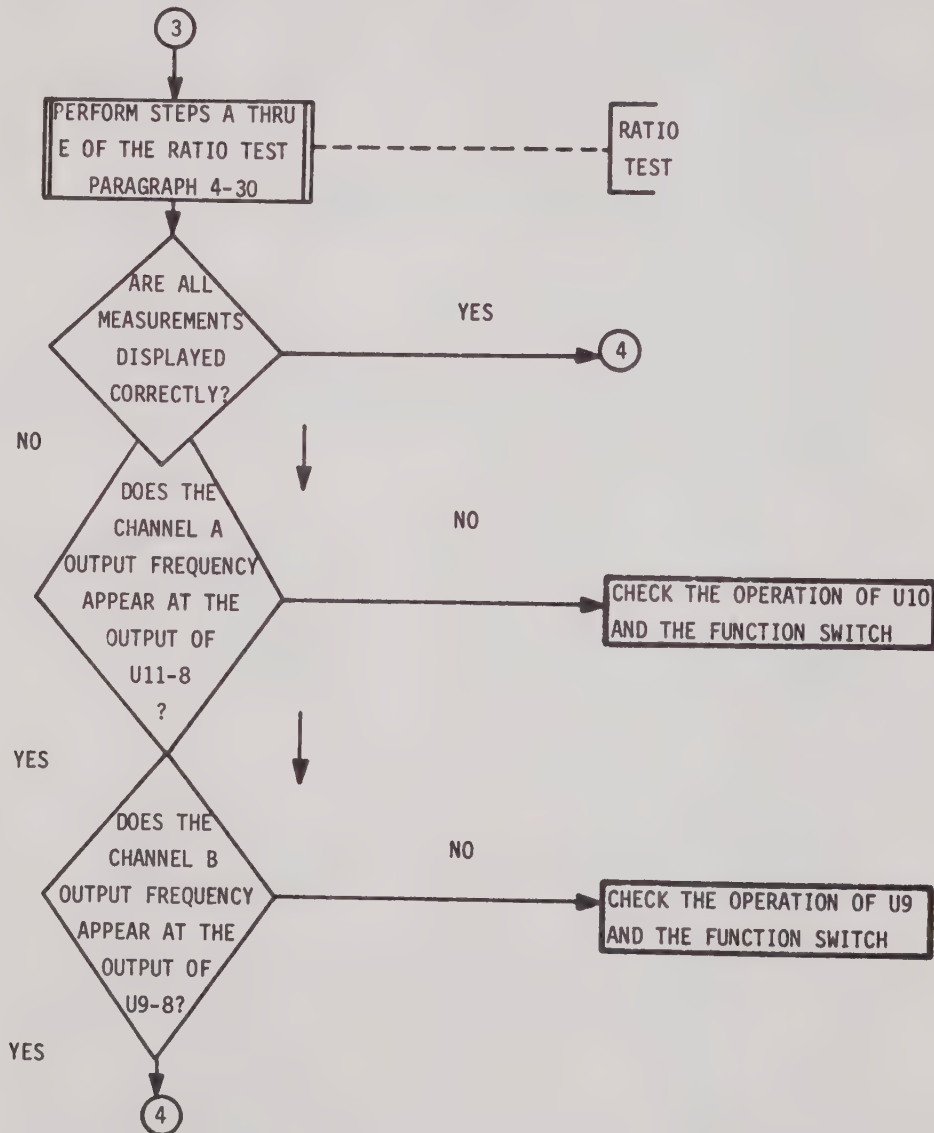


Figure 4-2. TROUBLESHOOTING FLOWCHARTS (Sheet 5 of 6)

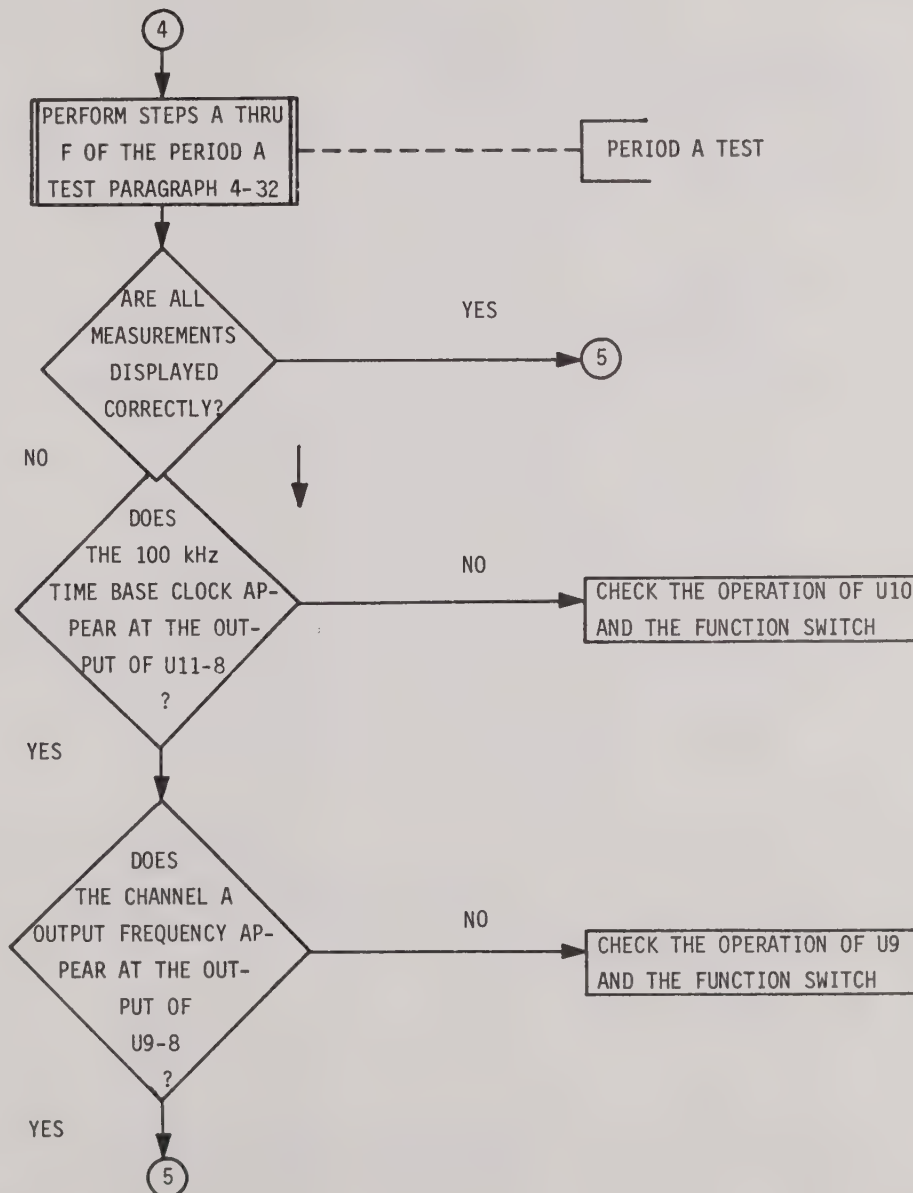
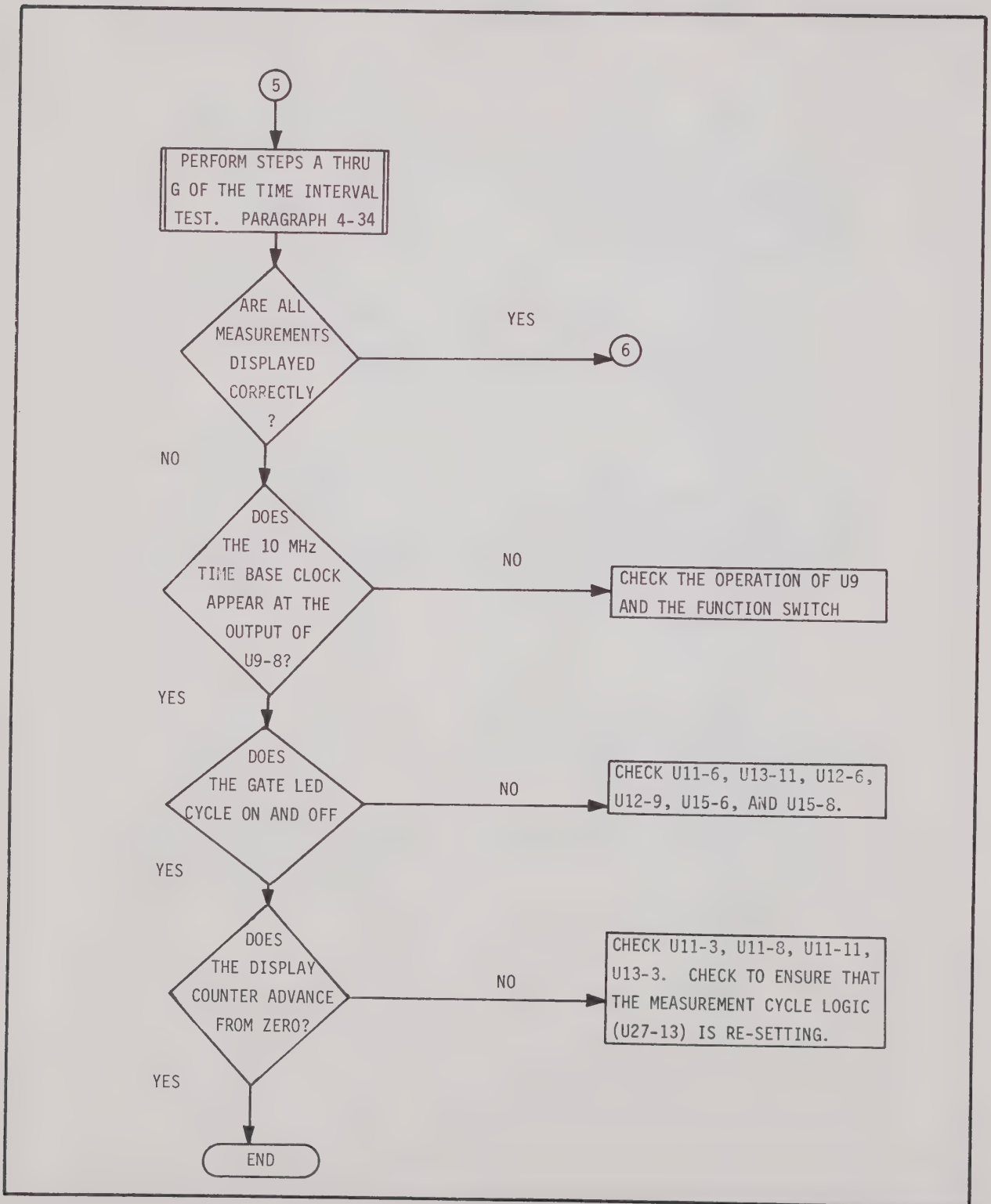


Figure 4-2. TROUBLESHOOTING FLOWCHARTS (Sheet 6 of 6)

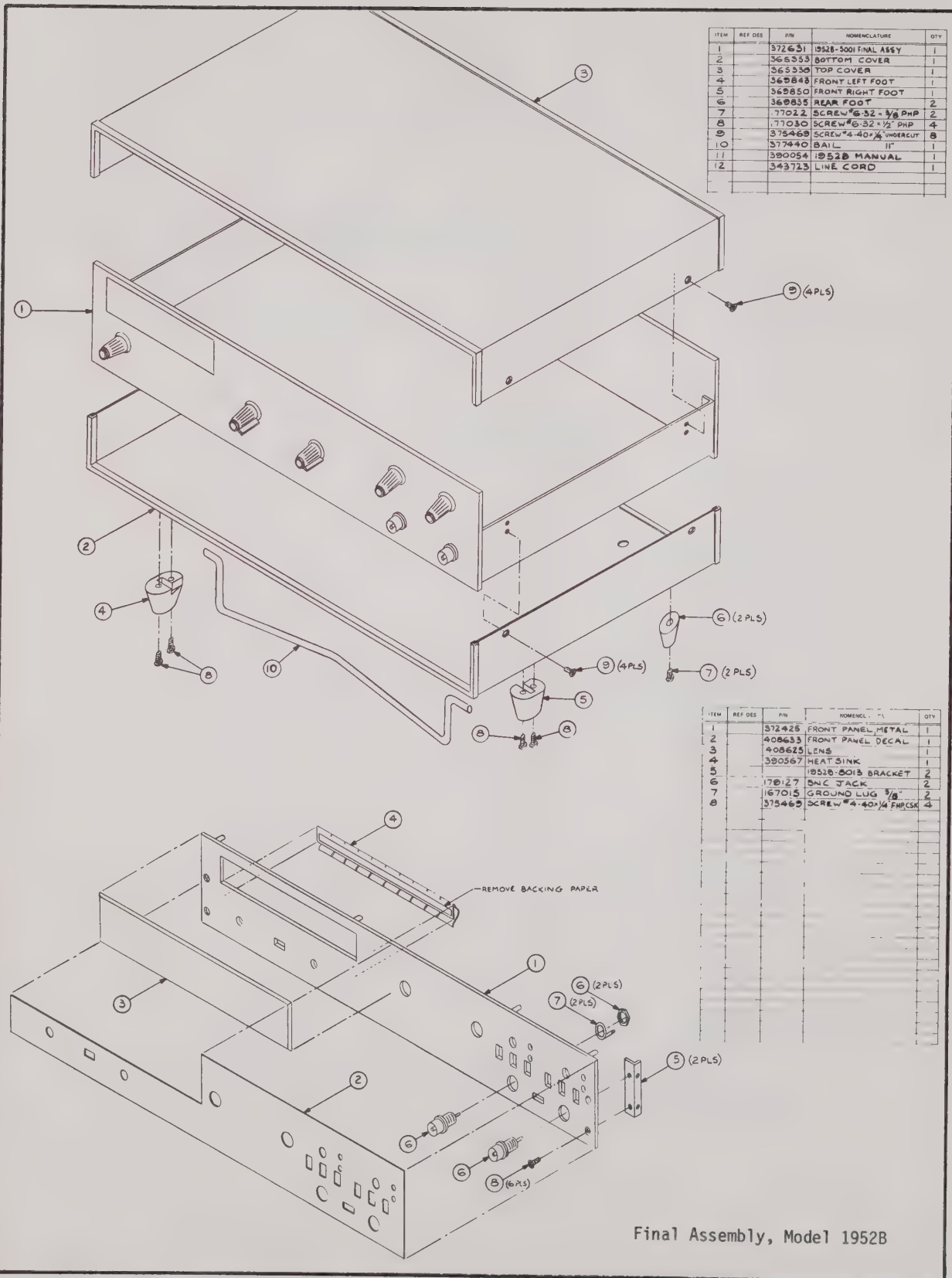


Section 5

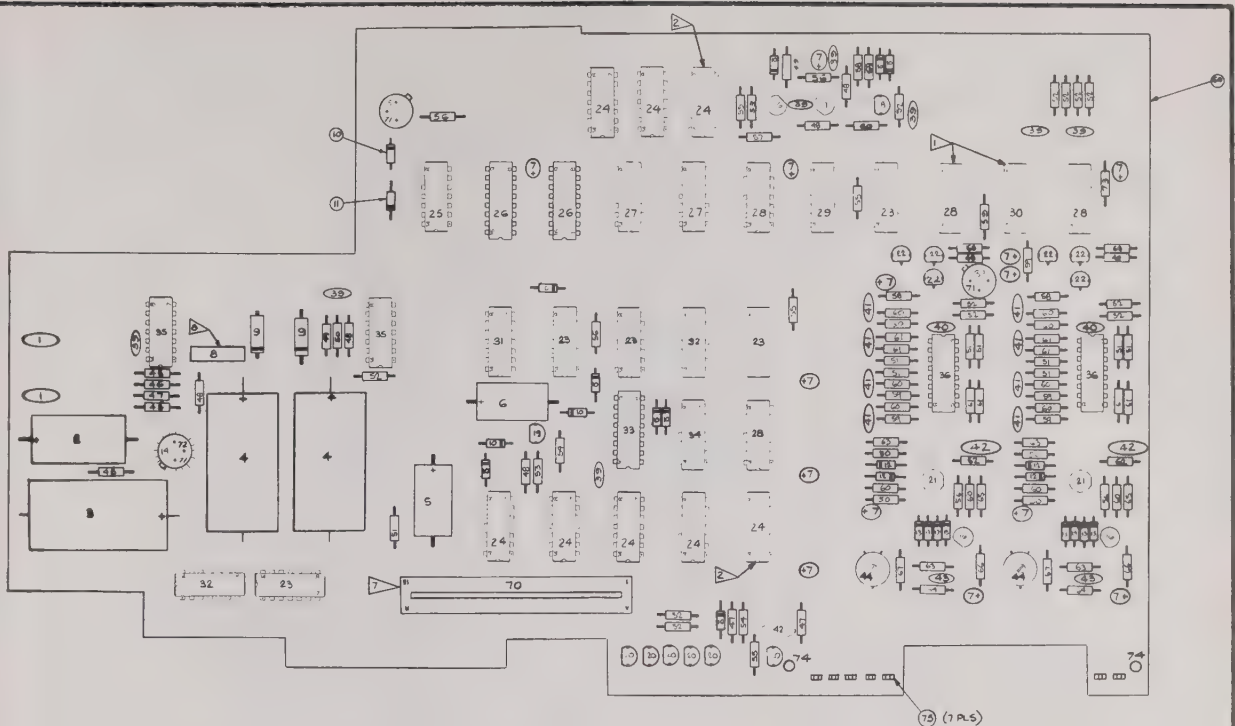
Lists of Replaceable Parts

TABLE OF CONTENTS

ASSEMBLY NAME	PAGE
Final Assembly, Model 1952B.....	5-2
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Display Board PCB Assembly.....	5-5
Input Board PCB Assembly.....	5-6
Switch Board PCB Assembly.....	5-7
Front Panel Assembly.....	5-8
Rear Panel Assembly.....	5-9



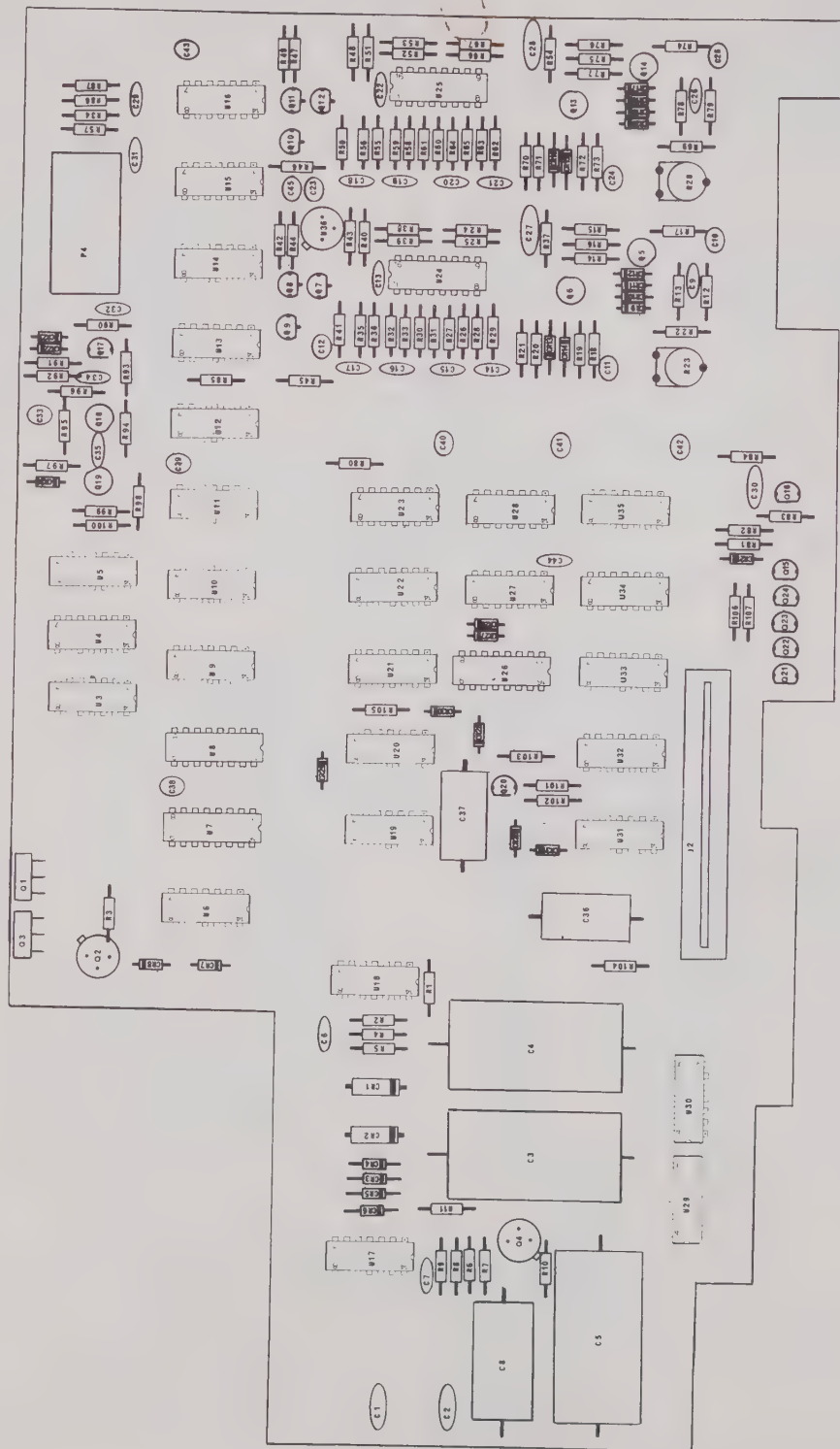
Final Assembly, Model 1952B



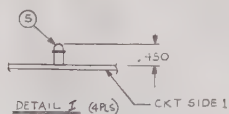
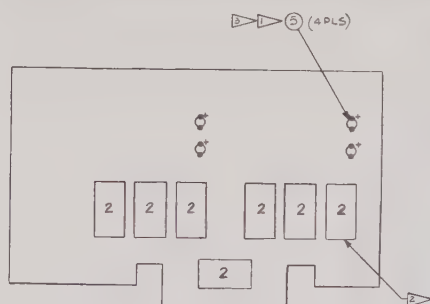
ITEM	REF DES	P/N#	NOMENCLATURE	QTY	ITEM	REF DES	P/N#	NOMENCLATURE	QTY
1	C1,C2	188003	CAPACITOR .005uF300V	2	40	C22,C36	360557	CAPACITOR .01uF 50V	2
2	C8	168153	470uF 25V	1	41	C4-C21	360157	22pF 500V	8
3	C5	234008	2200uF 25V	1	42	L1,L3,C30	360199	.1uF 25V	3
4	C3,C4	570370	4700uF 10V	2	43	C9,C26	360132	47pF 500V	2
5	C86	192314	100uF 16V	1	44	R13,R68	360553	RESISTOR TRIMPOT 10K	2
6	C37	360981	220uF 16V	1	45	R19,R10	170720	1/4W,5%CC2K7	3
7	D1	193623	10uF 16V	14	46	R8	148098	5K8	1
8	CR3-CR6	296609	DIODE BRIDGE KBPO2	2	47	R68,R64	148056	3K3	3
9	CR1,CR2	187716	1N4720	2	48	R1	147868	10	5
10	D1	364224	1N814	12	49	R10	148049	2K2	4
11	CR7	150798	1N751A	1	50	R11	190371	1K2	5
12	CR13-CR16	360989	FH100 OHMPS082-2835	4	51	R12	148013	820	9
13	D1	381806	1N5062	8	52	R13	148023	1K	12
14	Q4	266462	TRANSISTOR 2N2905	1	53	R39,R101	147975	390	2
15	Q2	150353	2N3003	1	54	R82,R103	93441	180K	2
16	Q6,Q4,Q3	360643	2N4274	3	55	R1	147918	68	4
17	Q18	360603	2N4257	1	56	R10	148007	680	5
18	Q17	386034	5K3819	1	57	R88	148114	5K	1
19	Q20	360652	5K4061	1	58	R45,R59	160804	270	3
20	D1	360678	1N5078	6	59	R1	147959	220	6
21	Q6,Q13	379271	5421	1	60	R1	147983	470	13
22	Q1-Q12	360629	2N5771	6	61	R1	148031	1K5	8
23	D1	252353	7400	5	62	R37,R54	148130	22K	2
24	D1	293159	7430	8	63	D1	147942	180	6
25	U6	363457	74511	1	64	R12,R79	148189	100K	2
26	U1,U6	363440	74512	2	65	R15,R16	148072	4K7	2
27	U8,U10	379289	74564	2	66	R17,R14	175042	1K8	2
28	D1	363580	74500	4	67	R12,R63	198330	2M2	2
29	U12	310227	7474	1	68	U11,U14,U16,U28	374290	19318-3001 MAIN PCB	1
30	U15	413617	74504	1	69	R91	182204	RESISTOR 1/4W,5%K 1M	1
31	U19	292393	7410	1	70	J2	362884	30PIN EDGE CONN	3
32	U23,U29	360571	7473	2	71	Q2,Q4,Q6	152207	TRANSI - PAD	3
33	U28	293142	7442	1	72	Q4	370155	HEAT SINK	1
34	U27	320754	74136	1	73	R88	147926	RESISTOR 1/4W,5%K 100	1
35	U17,U18	379420	723	2	74		375840	GUIDE PINS	2
36	U14,U15	3609102	10116	2	75		376574	AMP PINS	7
37	U86	375780	LM309H	1					
38									
39	D1	36014C	CAPACITOR .001uF	1					

NOTES:

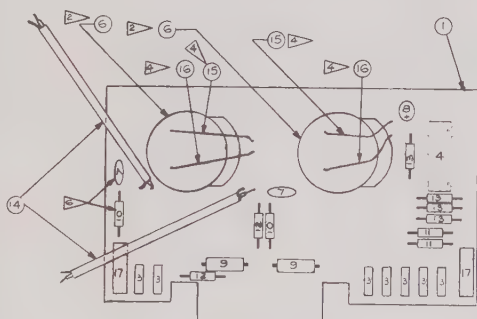
- 1 C10, C11, C12, C23, C24, C25, C33, C35, C39, C40, C41, C42, C43, C45.
- 2 CR8, CR11, CR12, CR22, CR23, CR24, CR25, CR26, CR27, CR28, CR29, CR30.
- 3 CR9, CR10, CR11, CR12, CR17, CR18, CR19, CR20.
- 4 Q15, Q16, Q21, Q22, Q28, Q24.
- 5 U15, U20, U21, U23, U30.
- 6 U3, U8, U9, U12, U33, U34, U35.
- 7 U11, U14, U16, U28.
- 8 C6, C7, C29, C31, C32, C34, C35, C44.
- 9 R2, R94, R96, R102, R11.
- 10 R5, R44, R47, R97.
- 11 R4, R18, R20, R71, R73.
- 12 R30, R31, R38, R39, R51, R53, R60, R61, R104.
- 13 R1, R34, R40, R43, R48, R51, R57, R66, R67, R90, R106, R107.
- 14 R80, R83, R85, R100.
- 15 R4, R77, R85, R105, R3.
- 16 R26, R25, R45, R46, R62, R63.
- 17 R16, R19, R27, R28, R36, R39, R56, R63, R64, R72, R73, R93.
- 18 R24, R28, R32, R33, R58, R59, R66, R67.
- 19 R13, R21, R42, R45, R70, R78.





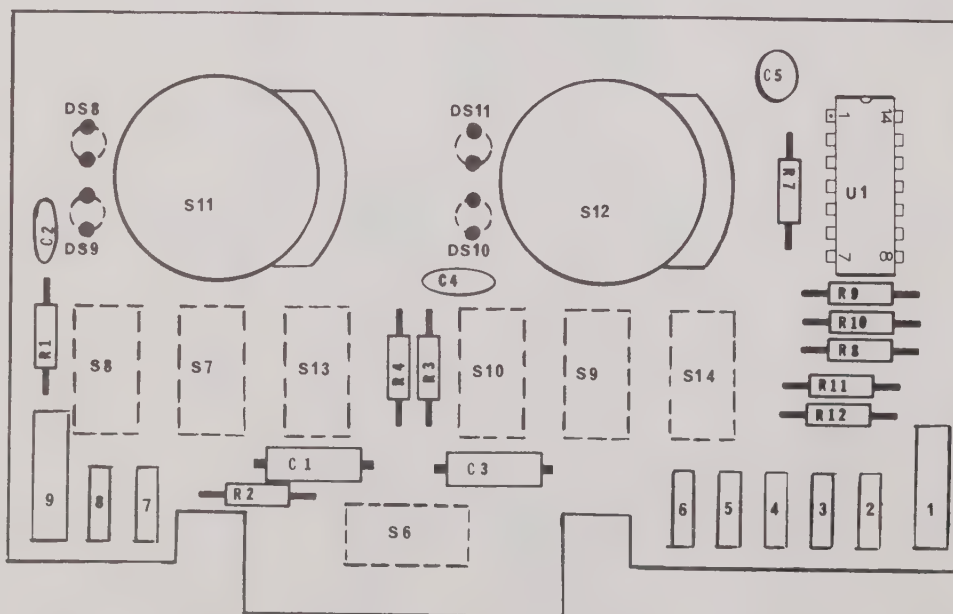


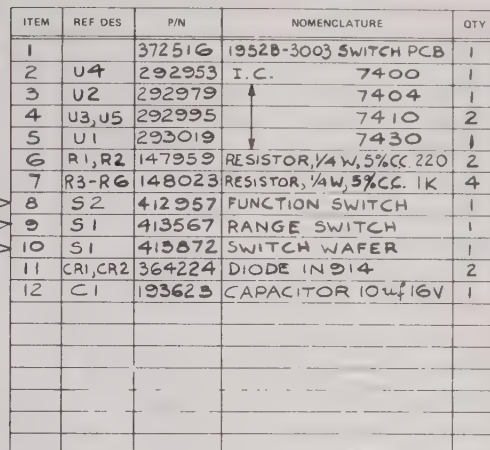
REV	REF DES	P/N	NOMENCLATURE	QTY
1		372514	INPUT PCB 1952B-3004	1
2		380115	SLIDE SWITCH	7
3		375329	AMP PIN RECEPTACLE	7
4		43617	I.C. 74504	1
5	DS8-DS11	385888	DIODE LED	4
6	R5, R6	370247	TRIMPOT 10K	2
7	C2, C4	105908	CAPACITOR 104/250V	2
8	C5	193623	104/10V	1
9	C1, C3	161992	RESISTOR 144/250V	2
10	R1, R3	285538	RESISTOR 144/250V	2
11	R2, R4	123441	100K	2
12	R7-R10	148189	100K	4
13		149484	82	4
14		190322	COAX CABLE 2 3/4" L.	2
15		115808	#22 TEFLON/VIOLET 2" L.	2
16		115766	#22 TEFLON, GRAY 2" L.	2
17	PI	48112	CONN TEST JACK	2



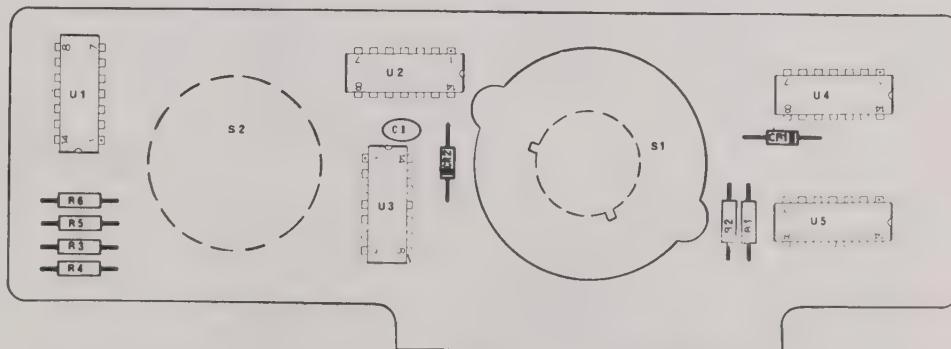
NOTES:

- THE POSITIVE LEAD OF ITEM 5 IS THE LONG LEAD.
 ITEMS 2 & 6 MUST BE INSTALLED PERPENDICULAR TO PCB.
 SEE DETAIL 1
 FINISHED LENGTH OF CABLE 2'
 S6, S7, S8, S9, S10, S13 & S14
 TRIM LEADS OF THESE COMPONENTS AS CLOSE TO PCB AS POSSIBLE.
 7 SEE SHT 2 OF 2 FOR WIRE LIST

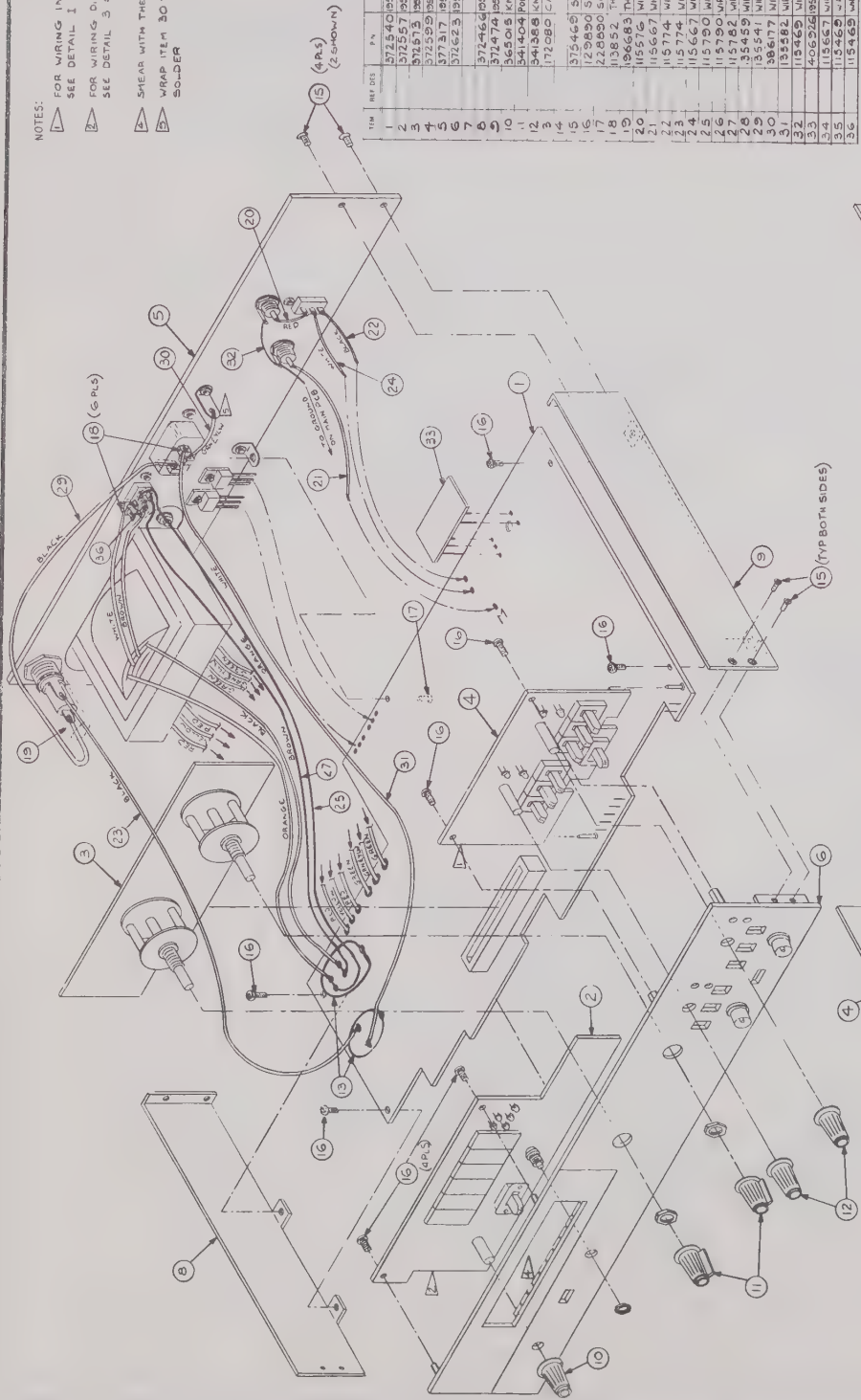




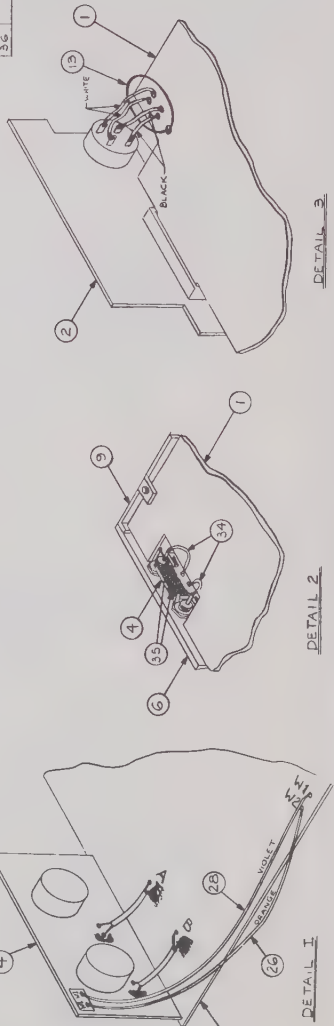
1. INSTALL ITEMS 8 & 9 ON CKT 1 SIDE.
2. ROTAR OF ITEM 10 MUST BE Clocked CORRECTLY WITH SHAFT OF ITEM 9
3. ITEM 9 IS SHOWN AT ITS CCW EXTREME POSITION WHEN VIEWED FROM CKT 1 SIDE.
4. REFERENCE SCHEMATIC 1952B-1003



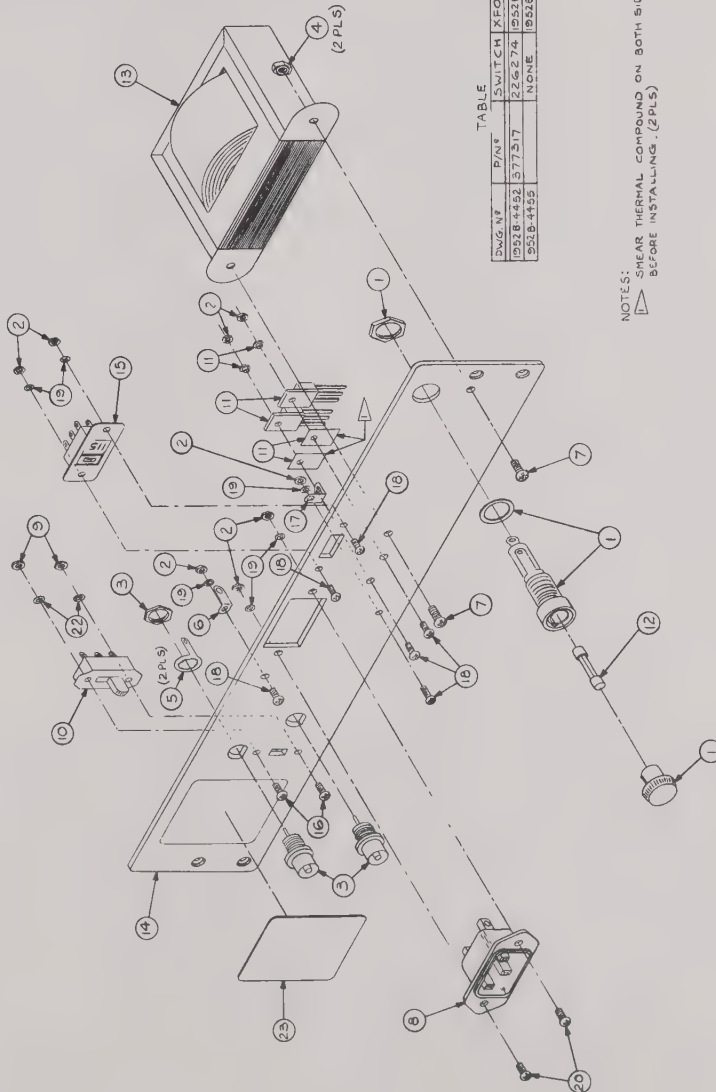
- NOTES:
- 1 FOR WIRING INPUT PCB ASSY ITEM 4
SEE DETAIL 1 & DETAIL 2
 - 2 FOR WIRING DISPLAY PCB ASSY ITEM 2
SEE DETAIL 3 & DET 2 of 2
 - 3 SHEAR WITH THERMAL COMPOUND.
WRAP ITEM 30 TWICE THRU HOLE AND
SOLDER



ITEM	REF DES	P/N	DESCRIPTION	QTY
1	373460	0518-4001	MAIN PCB ASSY	1
2	373461	0518-4002	DISPLAY PCB ASSY	1
3	373462	0518-4003	SWITCH PCB ASSY	1
4	373463	0518-4004	SWITCH PCB ASSY	1
5	373464	0518-4005	SWITCH PCB ASSY	1
6	373465	0518-4006	SWITCH PCB ASSY	1
7	373466	0518-4007	SWITCH PCB ASSY	1
8	373467	0518-4008	SWITCH PCB ASSY	1
9	373468	0518-4009	SWITCH PCB ASSY	1
10	373469	0518-4010	SWITCH PCB ASSY	1
11	373470	0518-4011	SWITCH PCB ASSY	1
12	373471	0518-4012	SWITCH PCB ASSY	1
13	373472	0518-4013	SWITCH PCB ASSY	1
14	373473	0518-4014	SWITCH PCB ASSY	1
15	373474	0518-4015	SWITCH PCB ASSY	1
16	373475	0518-4016	SWITCH PCB ASSY	1
17	373476	0518-4017	SWITCH PCB ASSY	1
18	373477	0518-4018	SWITCH PCB ASSY	1
19	373478	0518-4019	SWITCH PCB ASSY	1
20	373479	0518-4020	SWITCH PCB ASSY	1
21	373480	0518-4021	SWITCH PCB ASSY	1
22	373481	0518-4022	SWITCH PCB ASSY	1
23	373482	0518-4023	SWITCH PCB ASSY	1
24	373483	0518-4024	SWITCH PCB ASSY	1
25	373484	0518-4025	SWITCH PCB ASSY	1
26	373485	0518-4026	SWITCH PCB ASSY	1
27	373486	0518-4027	SWITCH PCB ASSY	1
28	373487	0518-4028	SWITCH PCB ASSY	1
29	373488	0518-4029	SWITCH PCB ASSY	1
30	373489	0518-4030	SWITCH PCB ASSY	1
31	373490	0518-4031	SWITCH PCB ASSY	1
32	373491	0518-4032	SWITCH PCB ASSY	1
33	373492	0518-4033	SWITCH PCB ASSY	1
34	373493	0518-4034	SWITCH PCB ASSY	1
35	373494	0518-4035	SWITCH PCB ASSY	1
36	373495	0518-4036	SWITCH PCB ASSY	1
37	373496	0518-4037	SWITCH PCB ASSY	1
38	373497	0518-4038	SWITCH PCB ASSY	1
39	373498	0518-4039	SWITCH PCB ASSY	1
40	373499	0518-4040	SWITCH PCB ASSY	1
41	373500	0518-4041	SWITCH PCB ASSY	1
42	373501	0518-4042	SWITCH PCB ASSY	1
43	373502	0518-4043	SWITCH PCB ASSY	1
44	373503	0518-4044	SWITCH PCB ASSY	1
45	373504	0518-4045	SWITCH PCB ASSY	1
46	373505	0518-4046	SWITCH PCB ASSY	1
47	373506	0518-4047	SWITCH PCB ASSY	1
48	373507	0518-4048	SWITCH PCB ASSY	1
49	373508	0518-4049	SWITCH PCB ASSY	1
50	373509	0518-4050	SWITCH PCB ASSY	1
51	373510	0518-4051	SWITCH PCB ASSY	1
52	373511	0518-4052	SWITCH PCB ASSY	1
53	373512	0518-4053	SWITCH PCB ASSY	1
54	373513	0518-4054	SWITCH PCB ASSY	1
55	373514	0518-4055	SWITCH PCB ASSY	1
56	373515	0518-4056	SWITCH PCB ASSY	1
57	373516	0518-4057	SWITCH PCB ASSY	1
58	373517	0518-4058	SWITCH PCB ASSY	1
59	373518	0518-4059	SWITCH PCB ASSY	1
60	373519	0518-4060	SWITCH PCB ASSY	1
61	373520	0518-4061	SWITCH PCB ASSY	1
62	373521	0518-4062	SWITCH PCB ASSY	1
63	373522	0518-4063	SWITCH PCB ASSY	1
64	373523	0518-4064	SWITCH PCB ASSY	1
65	373524	0518-4065	SWITCH PCB ASSY	1
66	373525	0518-4066	SWITCH PCB ASSY	1
67	373526	0518-4067	SWITCH PCB ASSY	1
68	373527	0518-4068	SWITCH PCB ASSY	1
69	373528	0518-4069	SWITCH PCB ASSY	1
70	373529	0518-4070	SWITCH PCB ASSY	1
71	373530	0518-4071	SWITCH PCB ASSY	1
72	373531	0518-4072	SWITCH PCB ASSY	1
73	373532	0518-4073	SWITCH PCB ASSY	1
74	373533	0518-4074	SWITCH PCB ASSY	1
75	373534	0518-4075	SWITCH PCB ASSY	1
76	373535	0518-4076	SWITCH PCB ASSY	1
77	373536	0518-4077	SWITCH PCB ASSY	1
78	373537	0518-4078	SWITCH PCB ASSY	1
79	373538	0518-4079	SWITCH PCB ASSY	1
80	373539	0518-4080	SWITCH PCB ASSY	1
81	373540	0518-4081	SWITCH PCB ASSY	1
82	373541	0518-4082	SWITCH PCB ASSY	1
83	373542	0518-4083	SWITCH PCB ASSY	1
84	373543	0518-4084	SWITCH PCB ASSY	1
85	373544	0518-4085	SWITCH PCB ASSY	1
86	373545	0518-4086	SWITCH PCB ASSY	1
87	373546	0518-4087	SWITCH PCB ASSY	1
88	373547	0518-4088	SWITCH PCB ASSY	1
89	373548	0518-4089	SWITCH PCB ASSY	1
90	373549	0518-4090	SWITCH PCB ASSY	1
91	373550	0518-4091	SWITCH PCB ASSY	1
92	373551	0518-4092	SWITCH PCB ASSY	1
93	373552	0518-4093	SWITCH PCB ASSY	1
94	373553	0518-4094	SWITCH PCB ASSY	1
95	373554	0518-4095	SWITCH PCB ASSY	1
96	373555	0518-4096	SWITCH PCB ASSY	1
97	373556	0518-4097	SWITCH PCB ASSY	1
98	373557	0518-4098	SWITCH PCB ASSY	1
99	373558	0518-4099	SWITCH PCB ASSY	1
100	373559	0518-4100	SWITCH PCB ASSY	1



ITEM	REF DES	P/N	NOMINATURE	QTY
1		100107	FUSE HOLDER	1
2		110635	NUT #4-40	3
3		110635	NUT #4-40	3
4		152813	SELF-LOCKING NUT #3	2
5		167015	SOLDER-LUG #8/8	2
6		102558	GROUND-LUG #4-40	1
7		152175	SCREW #6-32 x 1/2 PHP	2
8		264166	LINE RECEPTACLE	1
9		261362	NUT #2-56	2
10		110635	NUT #4-40	2
11		369560	TRANSISTOR TIP 32	2
12		369819	FUSE 1 AMP	2
13		377326	REAR PANEL 1952B-2013	1
14		347144	SWITCH 115/230 V	1
15		347144	SWITCH 115/230 V	1
16		110635	NUT #4-40	2
17		110635	NUT #4-40	2
18		266164	SCREW #4-40 #4	6
19		110403	INTERNAL WASHER #4	6
20		145813	SCREW #4-40 1/2 PHP	2
21		110676	INTERNAL WASHER #2	2
22		110676	INTERNAL WASHER #2	2
23		155840	1952B-5006 DECAL OPTION	1



TABLE

SWG N°	P/N°	SWITCH	XFORMER	S/N
1952B-4432	377317	226274	1952B-6568	370544
1952B-4435	NONE	NONE	1952B-6510	370551

NOTES:
 SHEAR THERMAL COMPOUND ON BOTH SIDES
 BEFORE INSTALLING (2PLS)

Section 6

Option & Accessory Information

6-1 INTRODUCTION

6-2 This section of the manual contains information pertaining to the accessories and -03 option available for your instrument.

6-3 ACCESSORY INFORMATION

6-4 1952B rack adapter M00-200-614. Printer Interface Kit 2010A - 7011.

6-5 OPTION INFORMATION

6-6 The -03 option provides a 8 digit LED display and includes a Temperature Compensated Crystal Oscillator (TCX0) which has timebase stability and temperature dependent characteristics which are superior to the oscillator normally installed in the standard unit.

The TCX0 specifications are as follows:

FREQUENCY	10.00 MHz
AGING RATE (per month)	$< \pm 3 \times 10^{-7}$
TEMPERATURE STABILITY 0 - 50°C 20 - 30°C	$< \pm 2 \times 10^{-6}$ $\pm 5 \times 10^{-7}$ typ.
LINE VOLTAGE ($\pm 10\%$ CHANGE)	$< \pm 1 \times 10^{-7}$

Section 7

General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable parts contained in Section 5. The following information is presented in this section:

List of Abbreviations

Federal Supply Codes for Manufacturers

Fluke Technical Service Centers — U.S. and Canada

Sales and Service Locations — International

Sales Representatives — U.S. and Canada

List of Abbreviations and Symbols

A or amp	ampere	H	henry	pF	picofarad
ac	alternating current	hd	heavy duty	pn	part number
af	audio frequency	hf	high frequency	(+) or pos	positive
a/d	analog-to-digital	Hz	hertz	pot	potentiometer
assy	assembly	IC	integrated circuit	p-p	peak-to-peak
AWG	american wire gauge	if	intermediate frequency	ppm	parts per million
B	bel	in	inch(es)	PROM	programmable read-only memory
bcd	binary coded decimal	intl	internal	psi	pound-force per square inch
°C	Celsius	I/O	input/output	RAM	random-access memory
cap	capacitor	k	kilo (10 ³)	rf	radio frequency
ccw	counterclockwise	kHz	kilohertz	rms	root mean square
cer	ceramic	kΩ	kilohm(s)	ROM	read-only memory
cermet	ceramic to metal(seal)	kV	kilovolt(s)	s or sec	second (time)
ckt	circuit	lf	low frequency	scope	oscilloscope
cm	centimeter	LED	light-emitting diode	SH	shield
cmrr	common mode rejection ratio	LSB	least significant bit	Si	silicon
comp	composition	LSD	least significant digit	serno	serial number
cont	continue	M	mega (10 ⁶)	sr	shift register
crt	cathode-ray tube	m	milli (10 ⁻³)	Ta	tantalum
cw	clockwise	mA	milliampere(s)	tb	terminal board
d/a	digital-to-analog	max	maximum	tc	temperature coefficient or temperature compensating
dac	digital-to-analog converter	mf	metal film	tcxo	temperature compensated crystal oscillator
dB	decibel	MHz	megahertz	tp	test point
dc	direct current	min	minimum	u or μ	micro (10 ⁻⁶)
dmm	digital multimeter	mm	millimeter	uhf	ultra high frequency
dvm	digital voltmeter	ms	millisecond	us or μs	microsecond(s) (10 ⁻⁶)
elect	electrolytic	MSB	most significant bit	uut	unit under test
ext	external	MSD	most significant digit	V	volt
F	farad	MTBF	mean time between failures	v	voltage
°F	Fahrenheit	MTTR	mean time to repair	var	variable
FET	Field-effect transistor	mV	millivolt(s)	vco	voltage controlled oscillator
ff	flip-flop	mv	multivibrator	vhf	very high frequency
freq	frequency	MΩ	megohm(s)	vlf	very low frequency
FSN	federal stock number	n	nano (10 ⁻⁹)	W	watt(s)
g	gram	na	not applicable	ww	wire wound
G	giga (10 ⁹)	NC	normally closed	xfmr	transformer
gd	guard	(-) or neg	negative	xstr	transistor
Ge	germanium	NO	normally open	xtal	crystal
GHz	gigahertz	ns	nanosecond	xtlo	crystal oscillator
gmV	guaranteed minimum value	opnl ampl	operational amplifier	Ω	ohm(s)
gnd	ground	p	pico (10 ⁻¹²)	μ	micro (10 ⁻⁶)
		para	paragraph		
		pcb	printed circuit board		

Federal Supply Codes for Manufacturers (Continued)

00213 Nytronics Comp. Group Inc. Subsidiary of Nytronics Inc. Formerly Sage Electronics Rochester, New York	03797 Eldema Div. Genisco Technology Corp. Compton, California	05574 Viking Industries Chatsworth, California	07597 Burndy Corp. Tape/Cable Div. Rochester, New York
00327 Welwyn International, Inc. Westlake, Ohio	03877 Transistron Electronic Corp. Wakefield, Massachusetts	05704 Replaced by 16258	07792 Lerma Engineering Corp. Northampton, Massachusetts
00656 Aerovox Corp. New Bedford, Massachusetts	03888 KDI Pyrofilm Corp. Whippany, New Jersey	05820 Wakefield Engineering Inc. Wakefield, Massachusetts	07910 Teledyne Semiconductor Formerly Continental Device Hawthorne, California
00686 Film Capacitors, Inc. Passaic, New Jersey	03911 Clairex Electronics Div. Clairex Corp. Mt. Vernon, New York	06001 General Electric Co. Electronic Capacitor & Battery Products Dept. Columbia, South Carolina	07933 - use 49956 Raytheon Co. Semiconductor Div. HQ Mountain View, California
00779 AMP Inc. Harrisburg, Pennsylvania	03980 Muirhead Inc. Mountainside, New Jersey	06136 Replaced by 63743	08225 Industro Transistor Corp. Long Island City, New York
01121 Allen-Bradley Co. Milwaukee, Wisconsin	04009 Arrow Hart Inc. Hartford, Connecticut	06383 Panduit Corp. Tinley Park, Illinois	08261 Spectra Strip Corp. Garden Grove, California
01281 TRW Electronic Comp. Semiconductor Operations Lawndale, California	04062 Replaced by 72136	06473 Bunker Ramo Corp. Amphenol SAMS Div. Chatsworth, California	08530 Reliance Mica Corp. Brooklyn, New York
01295 Texas Instruments, Inc. Semiconductor Group Dallas, Texas	04202 Replaced by 81312	06555 Beede Electrical Instrument Co. Penacook, New Hampshire	08806 General Electric Co. Miniature Lamp Products Dept. Cleveland, Ohio
01537 Motorola Communications & Electronics Inc. Franklin Park, Illinois	04217 Essex International Inc. Wire & Cable Div. Anaheim, California	06739 Electron Corp. Littleton, Colorado	08863 Nylomatic Corp. Norrisville, Pennsylvania
01686 RCL Electronics Inc. Manchester, New Hampshire	04221 Aemco, Div. of Midtex Inc. Mankato, Minnesota	06743 Clevite Corp. Cleveland, Ohio	08988 - use 53085 Skottie Electronics Inc. Archbald, Pennsylvania
01730 Replaced by 73586	04222 AVX Ceramics Div. AVX Corp. Myrtle Beach, Florida	06751 Components, Inc. Semcor Div. Phoenix, Arizona	09214 G.E. Co. Semi-Conductor Products Dept. Power Semi-Conductor Products OPN Sec. Auburn, New York
01884 - use 56289 Sprague Electric Co. Dearborn Electronic Div. Lockwood, Florida	04423 Telonic Industries Laguna Beach, California	06860 Gould Automotive Div. City of Industry, California	09353 C and K Components Watertown, Massachusetts
02114 Ferroxcube Corp. Saugerties, New York	04645 Replaced by 75376	06961 Vernitron Corp., Piezo Electric Div. Formerly Clevite Corp., Piezo Electric Div. Bedford, Ohio	09423 Scientific Components, Inc. Santa Barbara, California
02131 General Instrument Corp. Harris ASW Div. Westwood, Maine	04713 Motorola Inc. Semiconductor Products Phoenix, Arizona	06980 Eimac Div. Varian Associates San Carlos, California	09922 Burndy Corp. Norwalk, Connecticut
02395 Rason Mfg. Co. Brooklyn, New York	04946 Standard Wire & Cable Los Angeles, California	07047 Ross Milton, Co., The South Hampton, Pennsylvania	09969 Dale Electronics Inc. Yankton, S. Dakota
02533 Snelgrove, C.R. Co., Ltd. Don Mills, Ontario, Canada M3B 1M2	05082 Replaced by 94988	07115 Replaced by 14674	10059 Barker Engineering Corp. Formerly Amerace, Amerace ESNA Corp. Kenilworth, New Jersey
02606 Fenwal Labs Div. of Travenal Labs. Morton Grove, Illinois	05236 Jonathan Mfg. Co. Fullerton, California	07138 Westinghouse Electric Corp., Electronic Tube Division Horsehead, New York	11236 CTS of Berne Berne, Indiana
02660 Bunker Ramo Corp., Conn Div. Formerly Amphenol-Borg Electric Corp. Broadview, Illinois	05245 Components Corp. now Corcom, Inc. Chicago, Illinois	07233 TRW Electronic Components Cinch Graphic City of Industry, California	11237 CTS Keene Inc. Paso Robles, California
02799 Aero Capacitors, Inc. Chatsworth, California	05277 Westinghouse Electric Corp. Semiconductor Div. Youngwood, Pennsylvania	07256 Silicon Transistor Corp. Div. of BBF Group Inc. Chelmsford, MA	11358 CBS Electronic Div. Columbia Broadcasting System Newburyport, MN
03508 General Electric Co. Semiconductor Products Syracuse, New York	05278 Replaced by 43543	07261 Aumet Corp. Culver City, California	11403 Best Products Co. Chicago, Illinois
03614 Replaced by 71400	05397 Union Carbide Corp. Materials Systems Div. New York, New York	07263 Fairchild Semiconductor Div. of Fairchild Camera & Instrument Corp. Mountain View, California	11503 Keystone Columbia Inc. Warren, Michigan
03651 Replaced by 44655	05571 - use 56289 Sprague Electric Co. Pacific Div. Los Angeles, California	07344 Bircher Co., Inc. Rochester, New York	11532 Teledyne Relays Hawthorne, California

Federal Supply Codes for Manufacturers (Continued)

11711 General Instrument Corp Rectifier Division Hickville, New York	14099 Semtech Corp. Newbury Park, California	17069 Circuit Structures Lab. Burbank, California	24655 General Radio Concord, Massachusetts
11726 Qualidyne Corp. Santa Clara, California	14140 Edison Electronic Div. Mc Gray-Edison Co. Manchester, New Hampshire	17338 High Pressure Eng. Co., Inc. Oklahoma City, Oklahoma	24759 Lenox-Fugle Electronics Inc. South Plainfield, New Jersey
12014 Chicago Rivet & Machine Co. Bellwood, Illinois	14193 Cal-R-Inc. formerly California Resistor, Corp. Santa Monica, California	17545 Atlantic Semiconductors, Inc. Asbury Park, New Jersey	25088 Siemen Corp. Isilen, New Jersey
12040 National Semiconductor Corp. Danbury, Connecticut	14298 American Components, Inc. an Insilco Co. Conshohocken, Pennsylvania	17856 Siliconix, Inc. Santa Clara, California	25403 Amperex Electronic Corp. Semiconductor & Micro-Circuits Div. Slatersville, Rhode Island
12060 Diodes, Inc. Chatsworth, California	14655 Cornell-Dublier Electronics Division of Federal Pacific Electric Co. Govt. Control Dept. Newark, New Jersey	17870 Replaced by 14140	27014 National Semiconductor Corp. Santa Clara, California
12136 Philadelphia Handle Co. Camden, New Jersey	14752 Electro Cube Inc. San Gabriel, California	18178 Vactec Inc. Maryland Heights, Missouri	27264 Molex Products Downers Grove, Illinois
12300 Potter-Brumfield Division AMF Canada LTD. Guelph, Onatrio, Canada	14869 Replaced by 96853	18324 Signetics Corp. Sunnyvale, California	28213 Minnesota Mining & Mfg. Co. Consumer Products Div. St. Paul, Minnesota
12323 Presin Co., Inc. Shelton, Connecticut	14936 General Instrument Corp. Semi Conductor Products Group Hicksville, New York	18612 Vishay Resistor Products Div. Vishay Intertechnology Inc. Malvern, Pennsylvania	28425 Serv-/Link formerly Bohannon Industries Fort Worth, Texas
12327 Freeway Corp. formerly Freeway Washer & Stamping Co. Cleveland, Ohio	15636 Elec-Trol Inc. Saugus, California	18736 Voltronics Corp. Hanover, New Jersey	28478 Deltrol Controls Div. Deltrol Corporation Milwaukee, Wisconsin
12443 Budd Co. The, Polychem Products Plastic Products Div. Bridgeport, PA	15801 Fenwal Electronics Inc. Div. of Kidde Walter and Co., Inc. Framingham, Massachusetts	18927 G T E Sylvania Inc. Precision Material Group Parts Division Titusville, Pennsylvania	28480 Hewlett Packard Co. Corporate H.Q. Palo Alto, California
12615 U.S. Terminals Inc. Cincinnati, Ohio	15818 Teledyne Semiconductors, formerly Amelco Semiconductor Mountain View, California	19451 Perine Machinery & Supply Co. Seattle, Washington	28520 Heyman Mfg. Co. Kenilworth, New Jersey
12617 Hamlin Inc. Lake Mills, Wisconsin	15849 Litton Systems Inc. Usoco Div. formerly Usoco Inc. Van Nuys, California	19701 Electro-Midland Corp. Mepco-Electra Inc. Mineral Wells, Texas	29083 Monsanto, Co., Inc. Santa Clara, California
12697 Clarostat Mfg. Co. Dover, New Hampshire	15898 International Business Machines Corp. Essex Junction, Vermont	20584 Enochs Mfg. Inc. Indianapolis, Indiana	29604 Stackpole Components Co. Raleigh, North Carolina
12749 James Electronics Chicago, Illinois	15909 Replaced by 14140	20891 Self-Organizing Systems, Inc. Dallas, Texas	30148 A B Enterprise Inc. Ahoskie, North Carolina
12856 Micrometals Sierra Madre, California	16258 Space-Lok Inc. Burbank, California	21604 Buckeye Stamping Co. Columbus, Ohio	30323 Illinois Tool Works, Inc. Chicago, Illinois
12954 Dickson Electronics Corp. Scottsdale, Arizona	16299 Corning Glass Electronic Components Div. Raleigh, North Carolina	21845 Solitron Devices Inc. Transistor Division Riveria Beach, Florida	31091 Optimax Inc. Colmar, Pennsylvania
12969 Unitrode Corp. Watertown, Massachusetts	16332 Replaced by 28478	22767 ITT Semiconductors Palo Alto, California	32539 Mura Corp. Great Neck, New York
13103 Thermalloy Co., Inc. Dallas, Texas	16473 Cambridge Scientific Ind. Div. of Chemed Corporation Cambridge, Maryland	23050 Product Comp. Corp. Mount Vernon, New York	32767 Griffith Plastic Corp. Burlingame, California
13327 Solitron Devices Inc. Tappan, New York	16742 Paramount Plastics Fabricators, Inc. Downey, California	23332 Tracor Inc. Rockville, Maryland	32879 Advanced Mechanical Components Northridge, California
13511 Amphenol Cadre Div. Bunker-Ramo Corp. Los Gatos, California	16758 Delco Electronics Div. of General Motors Corp. Kokomo, Indiana	23880 Stanford Applied Engrng. Santa Clara, California	32897 Erie Technological Products, Inc. Frequency Control Div. Carlisle, Pennsylvania
13606 - use 56289 Sprague Electric Co. Transistor Div. Concord, New Hampshire	17001 Replaced by 71468	23936 Pamotor Div., Wm. J. Purdy Co. Burlingame, California	32997 Bourns Inc. Trimpot Products Division Riverside, California
13839 Replaced by 23732		24248 Replaced by 94222	33173 General Electric Co. Products Dept. Owensboro, Kentucky

Federal Supply Codes for Manufacturers (Continued)

34333 Silicon General Westminister, California	70563 Amperite Company Union City, New Jersey	73293 Hughes Aircraft Co. Electron Dynamics Div. Torrence, California	77969 Rubbercraft Corp. of CA. LTD. Torrance, California
34335 Advanced Micro Devices Sunnyvale, California	70903 Belden Corp. Geneva, Illinois	73445 Amperex Electronic Corp. Hicksville, LI, New York	78189 Shakeproof Div. of Illinois Tool Works Inc. Elgin, Illinois
34802 Electromotive Inc. Kenilworth, New Jersey	71002 Birnback Radio Co., Inc. Freeport, LI New York	73559 Carling Electric Inc. West Hartford, Connecticut	78277 Sigma Instruments, Inc. South Braintree, Massachusetts
37942 Mallory, P.R. & Co., Inc. Indianapolis, Indiana	71400 Bussmann Mfg. Div. of McGraw-Edison Co. Saint Louis, Missouri	73586 Circle F Industries Trenton, New Jersey	78488 Stackpole Carbon Co. Saint Marys, Pennsylvania
42498 National Radio Melrose, Massachusetts	71450 CTS Corp. Elkhart, Indiana	73734 Federal Screw Products, Inc. Chicago, Illinois	78553 Eaton Corp. Engineered Fastener Div. Tinnerman Plant Cleveland, Ohio
43543 Nytronics Inc. Transformer Co. Div. Geneva, New York	71468 ITT Cannon Electric Inc. Santa Ana, California	73743 Fischer Special Mfg. Co. Cincinnati, Ohio	79136 Waldes Kohinoor Inc. Long Island City, New York
44655 Ohmite Mfg. Co. Skokie, Illinois	71482 Clare, C.P. & Co. Chicago, Illinois	73899 JFD Electronics Co. Components Corp Brooklyn, New York	79497 Western Rubber Company Goshen, Indiana
49671 RCA Corp. New York, New York	71590 Centrelab Electronics Div. of Globe Union Inc. Milwaukee, Wisconsin	73949 Guardian Electric Mfg. Co. Chicago, Illinois	79963 Zierick Mfg. Corp. Mt. Kisko, New York
49956 Raytheon Company Lexington, Massachusetts	71707 Coto Coil Co., Inc. Providence, Rhode Island	74199 Quan Nichols Co. Chicago, Illinois	80031 Electro-Midland Corp., Mepco Div. A North American Phillips Co. Morristown, New Jersey
50088 Mostek Corp. Carrollton, Texas	71744 Chicago Miniature Lamp Works Chicago, Illinois	74217 Radio Switch Corp. Marlboro, New Jersey	80145 LFE Corp., Process Control Div. formerly API Instrument Co. Chesterland, Ohio
50579 Litronix Inc. Cupertino, California	71785 TRW Electronics Components Cinch Connector Operations Div. Elk Grove Village, Chicago, Illinois	74276 Signalite Div. General Instrument Corp. Neptune, New Jersey	80183 - use 56289 Sprague Products North Adams, Massachusetts
51605 Scientific Components Inc. Linden, New Jersey	72005 Driver, Wilber B., Co. Newark, New Jersey	74306 Piezo Crystal Co. Carlisle, Pennsylvania	80294 Bourns Inc., Instrument Div. Riverside, California
53021 Sangamo Electric Co. Springfield, Illinois	72092 Replaced by 06980	74542 Hoyt Elect. Instr. Works Penacook, New Hampshire	80583 Hammarlund Mfg. Co., Inc. Red Bank, New Jersey
54294 Cutler-Hammer Inc. formerly Shallcross, A Cutter-Hammer Co. Selma, North Carolina	72136 Electro Motive Mfg. Co. Williamantic, Connecticut	74970 Johnson E.F., Co. Waseca, Minnesota	80640 Stevens, Arnold Inc. South Boston, Massachusetts
55026 Simpson Electric Co. Div. of Am. Gage and Mach. Co. Elgin, Illinois	72259 Nytronics Inc. Pelham Manor, New Jersey	75042 TRW Electronics Components IRC Fixed Resistors Philadelphia, Pennsylvania	81073 Grayhill, Inc. La Grange, Illinois
56289 Sprague Electric Co. North Adams, Massachusetts	72619 Dialight Div. Amperex Electronic Corp. Brooklyn, New York	75376 Kurz-Kasch Inc. Dayton, Ohio	81312 Winchester Electronics Div. of Litton Industries Inc. Oakville, Connecticut
58474 Superior Electric Co. Bristol, Connecticut	72653 G.C. Electronics Div. of Hydrometals, Inc. Brooklyn, New York	75378 CTS Knights Inc. Sandwich, Illinois	81439 Therm-O-Disc Inc. Mansfield, Ohio
60399 Torin Corp. formerly Torrington Mfg. Co. Torrington, Connecticut	72665 Replaced by 90303	75382 Kulka Electric Corp. Mount Vernon, New York	81483 International Rectifier Corp. Los Angeles, California
63743 Ward Leonard Electric Co., Inc. Mount Vernon, New York	72794 Dzus Fastener Co., Inc. West Islip, New York	75915 Littlefuse Inc. Des Plaines, Illinois	81590 Korby Mfg. Co. Seattle, Washington
64834 West Mfg. Co. San Francisco, California	72928 Gulton Ind. Inc. Gudeman Div. Chicago, Illinois	76854 Oak Industries Inc. Switch Div. Crystal Lake, Illinois	81741 Chicago Lock Co. Chicago, Illinois
65092 Weston Instruments Inc. Newark, New Jersey	72982 Erie Tech. Products Inc. Erie, Pennsylvania	77342 AMF Inc. Potter & Brumfield Div. Princeton, Indiana	82305 Palmer Electronics Corp. South Gate, California
66150 Winslow Tele-Tronics Inc. Eaton Town, New Jersey	73138 Beckman Instruments Inc. Helipot Division Fullerton, California	77638 General Instrument Corp. Rectifier Division Brooklyn, New York	82389 Switchcraft Inc. Chicago, Illinois
70485 Atlantic India Rubber Works Chicago, Illinois			

Federal Supply Codes for Manufacturers (Concluded)

82415 North American Phillips Controls Corp. Frederick, Maryland	88245 Litton Systems Inc. Usecor Div. Van Nuys, California	91934 Miller Electric Co., Inc. Div of Aunet Woonsocket, Rhode Island	97966 Replaced by 11358
82872 Roanwell Corp. New York, New York	88419 Cornell-Dubilier Electronic Div. Federal Pacific Co. Fuquay-Varian, North Carolina	92194 Alpha Wire Corp. Elizabeth, New Jersey	98094 Replaced by 49956
82877 Rotron Inc. Woodstock, New York	88486 Plastic Wire & Cable Jewett City, Connecticut	93332 Sylvania Electric Products Semiconductor Products Div. Woburn, Massachusetts	98159 Rubber-Teck, Inc. Gardena, California
82879 ITT Royal Electric Div. Pawtucket, Rhode Island	88690 Replaced by 04217	94145 Replaced by 49956	98278 Malco A Microdot Co., Inc. Connector & Cable Div. Pasadena, California
83003 Varo Inc. Garland, Texas	89536 Fluke, John Mfg. Co., Inc. Seattle, Washington	94154 - use 94988 Wagner Electric Corp. Tung-Sol Div. Newark, New Jersey	98291 Sealectro Corp. Mamaroneck, New York
83058 Carr Co., The United Can Div. of TRW Cambridge, Massachusetts	89730 G.E. Co., Newark Lamp Works Newark, New Jersey	94222 Southco Inc. formerly South Chester Corp. Lester, Pennsylvania	98388 Royal Industries Products Div. San Diego, California
83298 Bendix Corp. Electric Power Division Eatontown, New Jersey	90201 Mallory Capacitor Co. Div of P.R. Mallory Co., Inc. Indianapolis, Indiana	95146 Alco Electronic Products Inc. Lawrence, Massachusetts	98743 Replaced by 12749
83330 Smith, Herman H., Inc. Brooklyn, New York	90211 - use 56365 Square D Co. Chicago, Illinois	95263 Leecraft Mfg. Co. Long Island City, New York	98925 Replaced by 14433
83478 Rubbercraft Corp. of America, Inc. West Haven, Connecticut	90215 Best Stamp & Mfg. Co. Kansas City, Missouri	95264 Replaced by 98278	99120 Plastic Capacitors, Inc. Chicago, Illinois
83594 Burroughs Corp. Electronic Components Div. Plainfield, New Jersey	90303 Mallory Battery Co. Div. of Mallory Co., Inc. Tarrytown, New York	95275 Vitramon Inc. Bridgeport, Connecticut	99217 Bell Industries Elect. Comp. Div. formerly Southern Elect. Div. Burbank, California
83740 Union Carbide Corp. Battery Products Div. formerly Consumer Products Div. New York, New York	91094 Essex International Inc. Suglex/IWP Div. Newmarket, New Hampshire	95303 RCA Corp. Receiving Tube Div. Cincinnati, Ohio	99392 STM Oakland, California
84171 Arco Electronics Great Neck, New York	91293 Johanson Mfg. Co. Boonton, New Jersey	95348 Gordo's Corp. Bloomfield, New Jersey	99515 ITT Jennings Monrovia Plant Div. of ITT Jennings formerly Marshall Industries Capacitor Div. Monrovia, California
84411 TRW Electronic Components TRW Capacitors Ogallala, Nebraska	91407 Replaced by 58474	95354 Methode Mfg. Corp. Rolling Meadows, Illinois	99779 - use 29587 Bunker-Ramo Corp. Barnes Div. Landsdowne, Pennsylvania
84613 Fuse Indicator Corp. Rockville, Maryland	91502 Associated Machine Santa Clara, California	95712 Bendix Corp. Electrical Components Div. Microwave Devices Plant Franklin, Indiana	99800 American Precision Industries Inc. Delevan Division East Aurora, New York
84682 Essex International Inc. Industrial Wire Div. Peabody, Massachusetts	91506 Augat Inc. Attleboro, Massachusetts	95987 Weckesser Co. Inc. Chicago, Illinois	99942 Centrelab Semiconductor Centrelab Electronics Div. of Globe-Union Inc. El Monte, California
86577 Precision Metal Products, of Malden Inc. Stoneham, Massachusetts	91637 Dale Electronics Inc. Columbus, Nebraska	96733 San Fernando Electric Mfg. Co. San Fernando, California	99942 Toyo Electronics (R-Ohm Corp.) Irvine, California
86684 Radio Corp. of America Electronic Components Div. Harrison, New Jersey	91662 Elco Corp. Willow Grove, Pennsylvania	96853 Gulton Industries Inc. Measurement and Controls Div. formerly Rustrak Instruments Co. Manchester, New Hampshire	National Connector Minneapolis, Minnesota
86928 Seastrom Mfg. Co., Inc. Glendale, California	91737 - use 71468 Gremar Mfg. Co., Inc. ITT Cannon/Gremar Santa Ana, California	96881 Thomson Industries, Inc. Manhasset, New York	
87034 Illuminated Products Inc. Subsidiary of Oak Industries Inc. Anahiem, California	91802 Industrial Devices, Inc. Edgewater, New Jersey	97540 Master Mobile Mounts Div. of Whitehall Electronics Corp. Ft. Meyers, Florida	
88219 Gould Inc. Industrial Div. Trenton, New Jersey	91836 Keystone Electronics Corp. New York, New York	97913 Industrial Electronic Hdware Corp. New York, New York	
	91836 King's Electronics Co., Inc. Tuckahoe, New York	97945 Penwalt Corp. SS White Industrial Products Div. Piscataway, New Jersey	
	91929 Honeywell Inc. Micro Switch Div. Freeport, Illinois		

Fluke Technical Service Centers — U.S. and Canada

United States

CALIFORNIA

Burbank

Fluke Western Technical Center
Mike Nagy, Service Manager
2020 N. Lincoln St.
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Santa Clara

Fluke Western Technical Center
Tom Marshall, Service Manager
2359 De La Cruz Blvd.
Zip: 95050
Tel. (408) 985-1200

COLORADO

Denver

Fluke Southwestern Tech. Ctr.
Roy Smith, Service Manager
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Unit 4
Zip: 80231
Tel. (303) 750-1228

FLORIDA

Orlando

Fluke S.E. Technical Center
Jesse Morse, Service Manager
P.O. Box 6578
940 N. Fern Creek Ave.
Zip: 32803
Tel. (305) 896-2296

ILLINOIS

Rolling Meadows

Fluke Midwestern Tech. Ctr.
Bruce Hunt, Service Manager
1400 Hicks Road
Zip: 60008
Tel. (312) 398-5800

NORTH CAROLINA

Greensboro

Fluke S.E. Technical Center
Dwain Cox, Service Manager
1310 Beaman Place
Zip: 27408
Tel. (919) 273-1918

MINNESOTA

Minneapolis

Fluke Midwestern Tech. Ctr.
Robert Wayne, Br. Manager
10800 Lyndale Ave. So.
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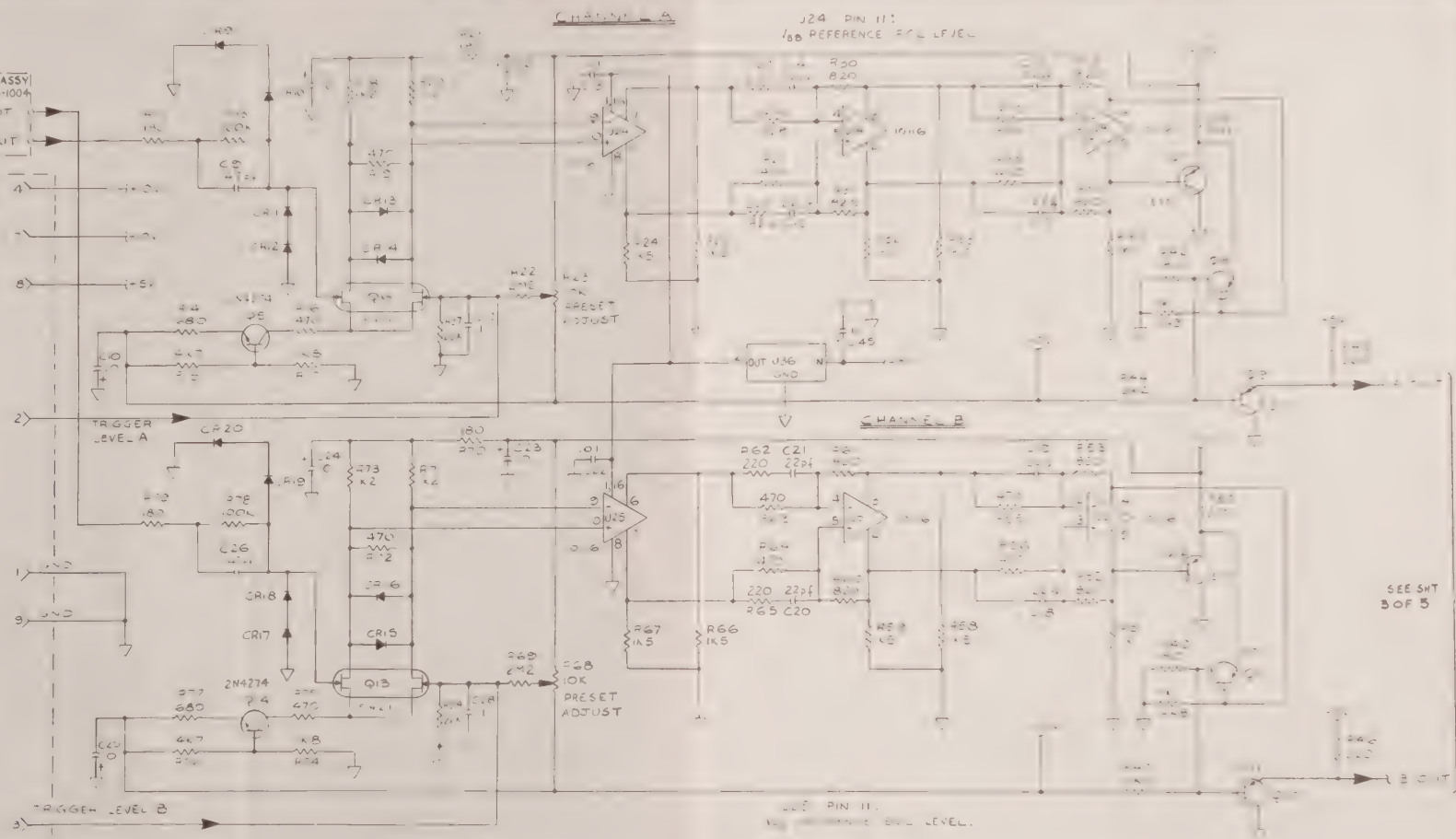
INPUT PCB ASSY
DWG N° 1952B-1004

B INPUT

A INPUT

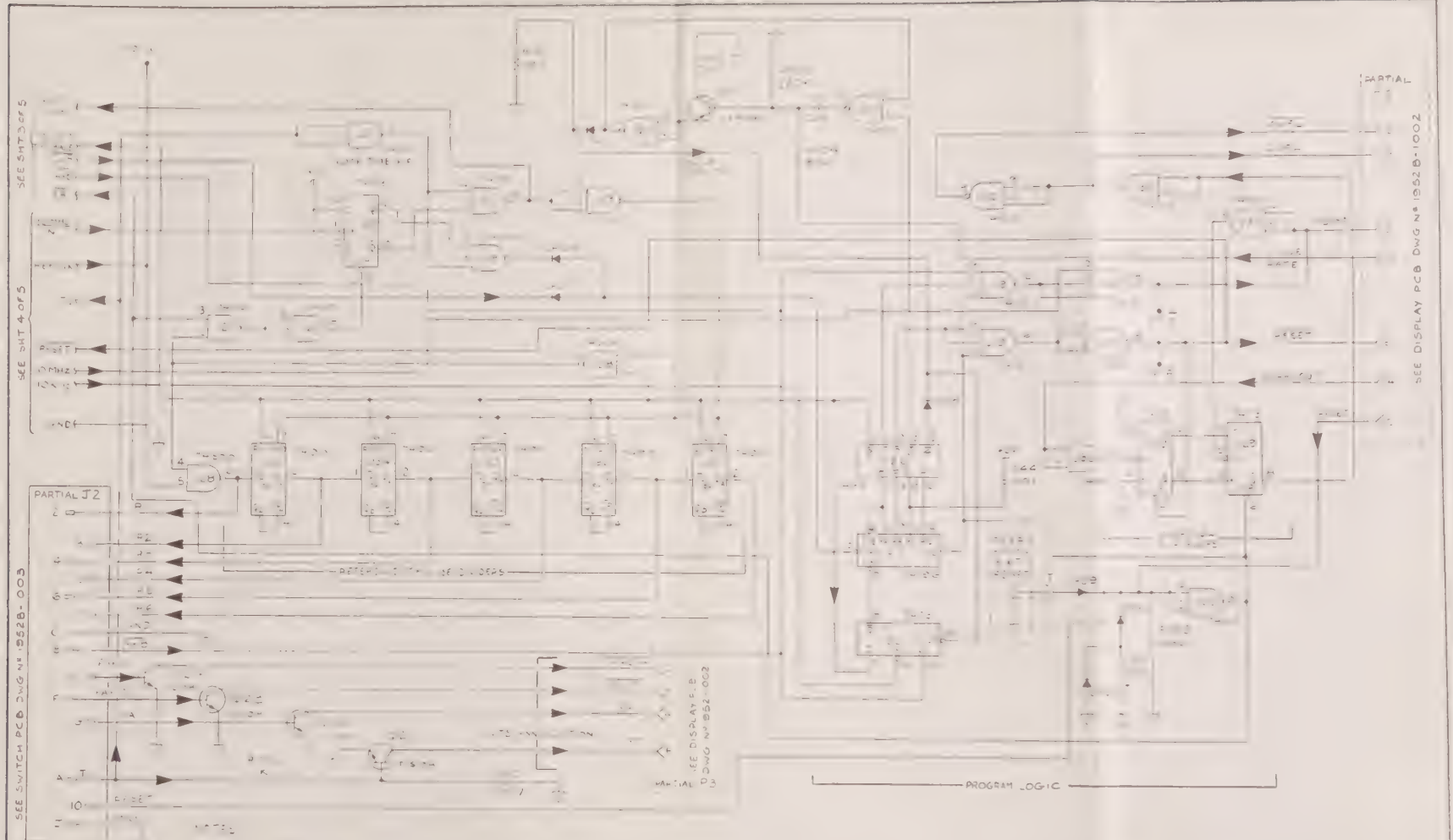
PARTIAL
PI

SEE INPUT PCB DWG N° 1952B-1004

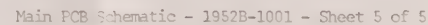


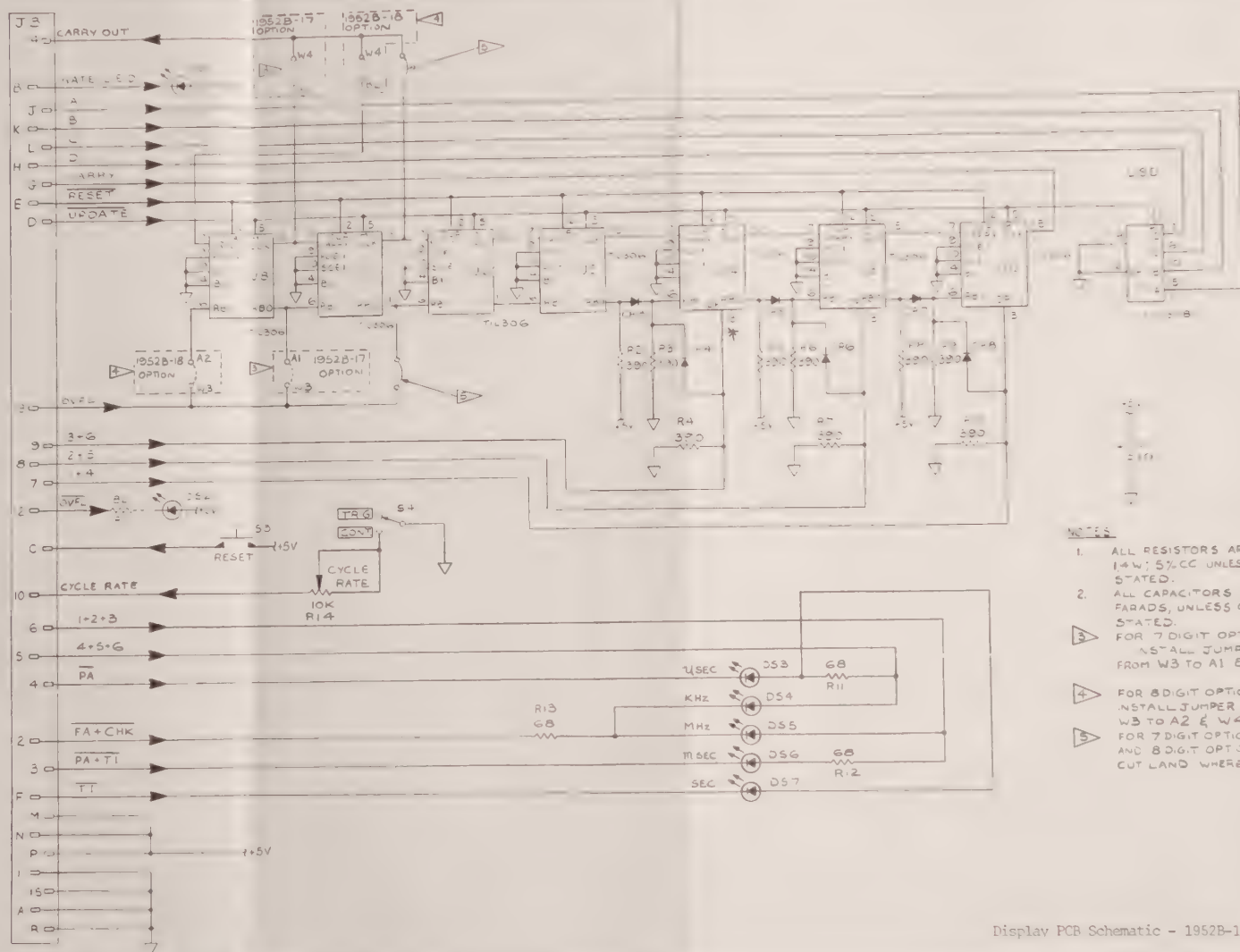
NOTES:
1. ALL RESISTORS ARE IN OHMS 1/4W; 5% C.C. UNLESS OTHERWISE STATED
2. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE STATED.

Pin PCB Input Amplifier Schematic - 1952B-

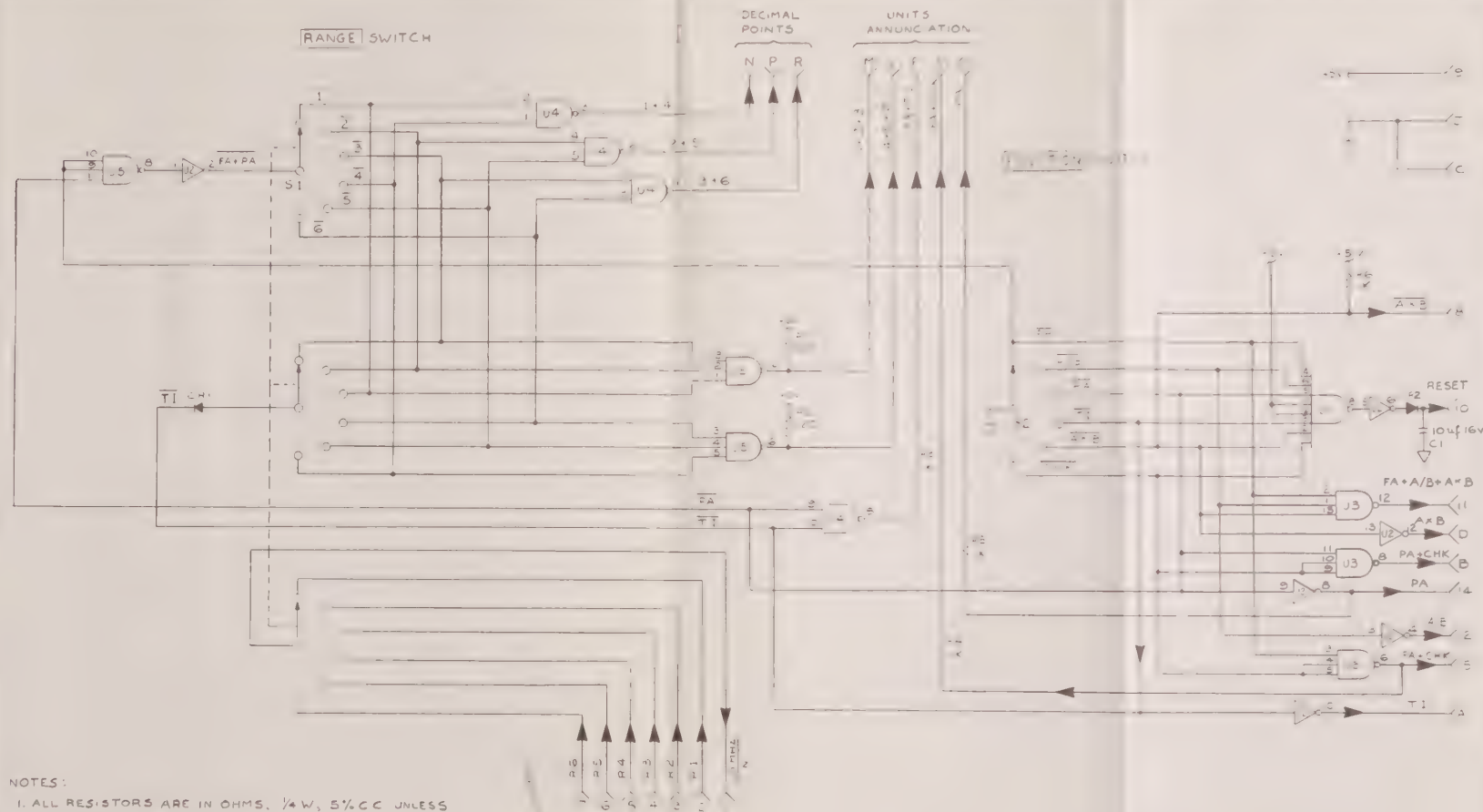


- 1 ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE STATED
- 2 ALL RESISTORS ARE IN OHMS, 1/4W, 5% C.C. UNLESS OTHERWISE STATED
- 3 U31, U32, U33, U34, U35, PINS: +5V, PIN 10: GND, PINS 4&13: DO NOT CARE





Display PCB Schematic - 1952B-1002 - Sheet 1 of 1



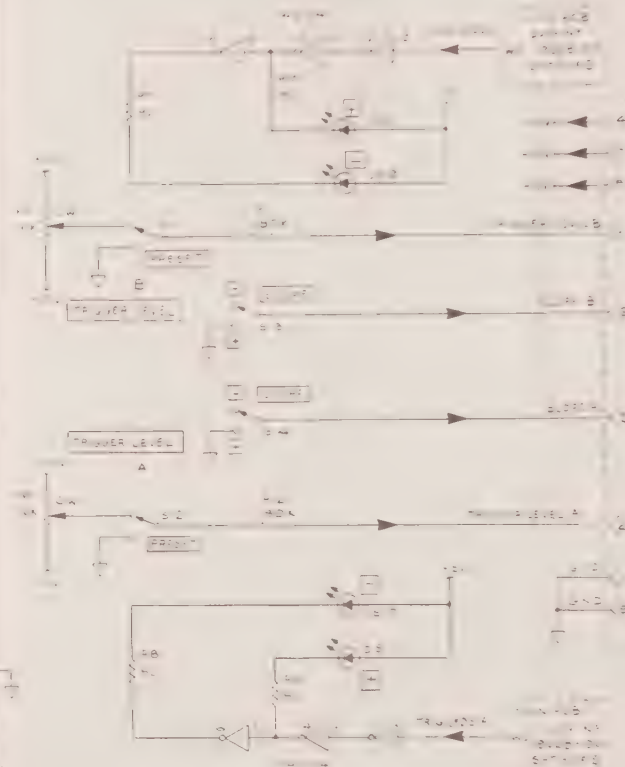
CHANNEL C
FRONT PANEL
INPUT BNC

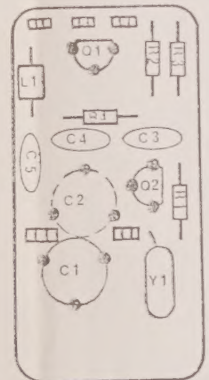
CHANNEL A
FRONT PANEL
INPUT BNC

NOTES:

1. ALL RESISTORS ARE IN OHMS, 1/4 W, 5% CC, UNLESS OTHERWISE STATED.
2. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE STATED.

TO MAIN PCB
DWG. N° 1952B-1001
SHT 2 OF 5





ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		406900	1952B-3010 TIMEBASE PCB	1
2	C3,C4	369187	CAPACITOR 22 p f	2
3	C5	368639	CAPACITOR .01 u f	1
4	C1,C2	369207	TRIMMER CAP. 22 pf	2
5	L1	320911	INDUCTOR	1
6	Y1	385732	CRYSTAL, SMALL 10MH ₂	1
7	R1	182204	RESISTOR 1/4 W, 5% CC. 1M	1
8	R2,R3,R4	153916	RESISTOR 1/8 W, 5% CC. 1K	3
9	Q1,Q2	386094	TRANSISTOR FET-N SX3819	2
10		376574	AMP PIN	5

DETAIL 1

NOTES:

1. REFERENCE SCHEMATIC 1952B-1010
2. ASSEMBLE PER S.O.P. 1118
3. TRIM LEADS .065 MAX. LONG PER S.O.P. 89.19
4. CLEAN ASSEMBLY PER S.O.P. 89.4, HANDLE CLEANED ASSY BY EDGES ONLY.
5. INSTALL CKT 1 SIDE.
6. SEE DETAIL 1.
7. ITEM 7 PREP DIFFERENTLY, E.G.



The diagram shows a cross-section of a component, likely a lead or wire, with a dimension line indicating a width of .400. A callout circle with the number 7 points to the top surface of the component.

